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State University of New York COLLEGE OF — 1990-91 CATALOG

ENVIRONMENTAL SCIENCE AND FORESTRY

Correspondence Directory

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The State University of New York College of Environmental Science and Forestry is accredited by the Middle States Association of Colleges and Secondary Schools: the B.S. degree program in Forestry is accredited by the Society of American Foresters; the A.A.S. degree program in Forest Technology is recognized by the Society of American Foresters; the B.L.A. and M.L.A. degree programs in landscape architecture are accredited by the American Society of Landscape Architects; and the B.S. degree program in forest engineering is accredited by the Accreditation Board for Engineering and Technology.

Additional information is available upon request from any of the above addresses. This undergraduate/graduate catalog was published by the College of Environmental Science and Forestry, June 1990.

The calendar, courses, tuition, and fees described in this catalog are subject to change at any time by official action either of the State University of New York Board of Trustees or of the College of Environmental Science and Forestry.

The State University of New York College of Environmental Science and Forestry does not discriminate on the basis of race, sex, religion, national origin, age, handicap, marital or veteran's status in admissions, employment, and treatment of students and employees in any program, activity, or service.

Coordinator for 503-504 Programs—Nick J. Paradiso, Jr., Vice President for Administration, 209 Bray Hall.

Affirmative Action Officer—Judith J. Kimberlin, Assistant Director of Personnel and Affirmative Action, 217 Bray Hall.

Campus Locator

Academic Affairs/Provost	207 Bray
Administration	208 Bray
Admissions Graduate)	227 Bray
Admissions (Undergraduate)	106 Bray
Affirmative Action	217 Bray
Alumni	204 Bray
Analytical and Technical Services	139 Baker
Business and Fiscal Affairs	100 Bray
Career Services	108 Bray
Cellulose Research Institute	314 Baker
Computer Services	320 Baker
Counseling Services	110 Bray
Development	205 Bray
Educational Communications	102 Moon
Empire State Paper Research Institute	208 Walters
Facilities	22 Bray
Faculty of Chemistry	318 Baker
Faculty of Environmental and Forest Biology	8 Illick
Faculty of Environmental Studies	320 Bray
Faculty of Forest Engineering	312 Bray
Faculty of Forestry	106 Marshall
Faculty of Landscape Architecture	331 Marshall
Faculty of Paper Science and Engineering	208 Walters
Faculty of Wood Products Engineering	403 Baker
Film Library	104 Moon
Financial Aid	115 Bray
Institutional Research	228 Bray
Instruction and Graduate Studies	227 Bray
Library	Moon Library
News and Publications	122 Bray
Nonresident Programs	218 Bray
Personnel	217 Bray
Physical Plant	Maintenance Building
Polymer Research Institute	215 Baker
President	223 Bray
Public Safety Department	8 Bray
Registrar	111 Bray
Research	200 Bray
Student Affairs and Educational Services	110 Bray
Student Council	22 Bray
Ultrastructure Studies Center	417 Baker
U.S. Forest Service Cooperative Research Unit	5 Moon
Veterans' Affairs	107 Bray

COLLEGEWIDE SMOKING POLICY

To help ensure the safety, quality and healthfulness of the teaching, learning and working conditions at the SUNY College of Environmental Science and Forestry, smoking within college-owned and controlled buildings and facilities and college-owned vehicles will not be permitted except in explicitly designated areas.

State University of New York

COLLEGE OF

ENVIRONMENTAL SCIENCE AND FORESTRY

1990-91 General Catalog

TABLE OF CONTENTS

Academic Calendar

SYRACUSE CAMPUS

FALL 1990

New Student Orientation Program	Aug. 24-27	Friday-Monday
Academic Advising	Aug. 27	Monday
Registration for New Students	Aug. 27	Monday
Classes Begin	Aug. 28	Tuesday
Labor Day (No classes)	Sept. 3	Monday
Fall Break	Oct. 6-9	Saturday-Tuesday
Thanksgiving Recess	Nov. 21-25	Wednesday-Sunday
Registration for Spring 1991	Nov. 26-Dec. 7	Monday-Friday
Last Day of Classes	Dec. 11	Tuesday
Reading Day	Dec. 12	Wednesday
Exam Period	Dec. 13-19	Thursday-Wednesday

SPRING 1991

Orientation and Advising for New Students	Jan. 7	Monday
Registration for New Students	Jan. 7	Monday
Classes Begin	Jan. 8	Tuesday
Martin Luther King Day (No classes)	Jan. 21	Monday
Spring Recess	Mar. 2-10	Saturday-Sunday
Registration for Fall 1991	Apr. 1-9	Monday-Tuesday
Last Day of Classes	Apr. 24	Wednesday
Reading Day	Apr. 25	Thursday
Exam Period	Apr. 26-May 2	Friday-Thursday
Commencement	May 5	Sunday

ESF: What's In A Name?

1911. Governor John A. Dix signed a bill establishing the New York State College of Forestry at Syracuse University.

1948. Legislative action incorporated into State University of New York all state-supported higher education. Thus, the State University College of Forestry at Syracuse University.

1972. By special legislative act, the College was renamed the State University of New York College of Environmental Science and Forestry.

Why, in the first place, all the name changes? And, secondly, what difference do they make? What, really, is in our name?

ESTABLISHING A TRADITION

The beginnings and early development of the New York State College of Forestry were largely due to James R. Day, chancellor of Syracuse University, and community leader who were attuned to the growing national sentiment favoring forest conservation and who sensed the need for a professional school of forestry. The legislative act which created the College instructed that the institution "conduct such special research in statewide investigations in forestry as will throw light upon and help in the solution of forestry problems . . ." and that it be "the institution for educational work in forestry in the State."

From the very first years of its existence under the first dean, Hugh P. Baker, the College responded to the broad needs of environmental professionalism. While other schools and colleges of forestry became more specialized, the College at Syracuse broadened to include the essentials of environmental science: design, engineering, and the life sciences, as well as resource management.

With the formation of the State University of New York in 1948, coordination and systematization came to higher education in the state. The University, according to its chapter, was to "supplement, not supplant, the great network of private colleges and universities." The College of Forestry, which from its beginning had been state-supported and governed by a Board of Trustees currently made up of nine members appointed by the Governor and six *ex officio* members, was recognized as a specialized college within the State University system.

Stemming from Chancellor Day's early sponsorship of the College, Syracuse University and ESF have enjoyed a long history of institutional cooperation. This relationship is probably the most outstanding example in this country of collaboration between public and private institutions of higher education. Even as a part of State University, the College maintains this unique position. The major character of the relationship stems from the fact that since its beginning, the College purchased from Syracuse University the major portion of its supportive and enrichment instruction, thus allowing the College to more fully develop its professional upper division and graduate level instruction.

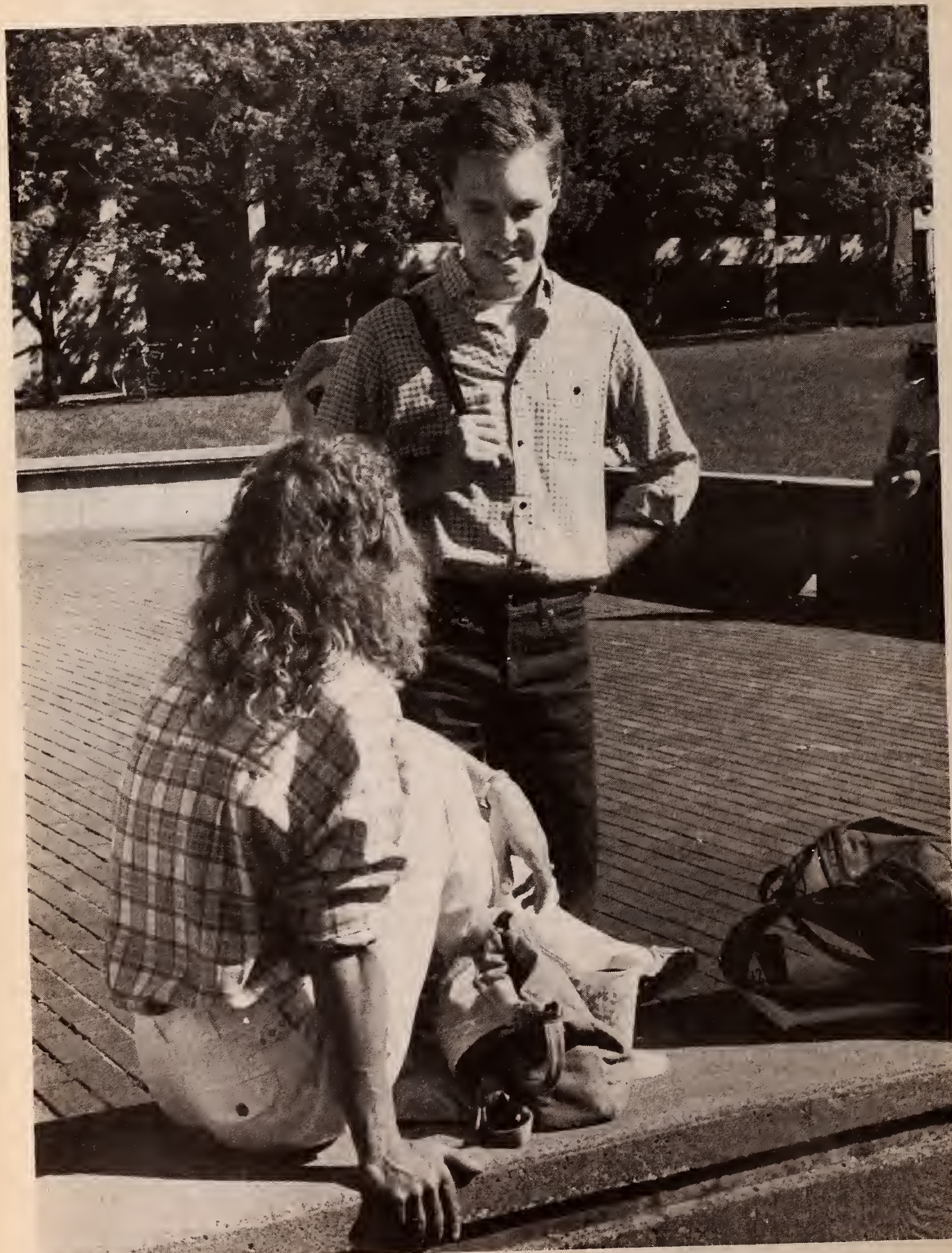
Other cooperative areas are living centers and dining facilities, athletic programs, the use of the University's infirmary and health counseling services, the bookstore facilities, the University library system, joint Commencement ceremonies held in the Carrier Dome, and participation in numerous social activities including the elaborate religious, dramatic, and cultural benefits of a large university.

ESF TODAY

The third phase in the evolvement of the College's name came in 1972 when it was rechartered as the State University of New York College of Environmental Science and Forestry. Thus, the name reflects more deeply the traditional grounding and concern of forestry in the environment; it illuminates more clearly the capabilities of its program.

The College of Environmental Science and Forestry is a specialized institution with highly focused professional programs. Undergraduate students wishing to embark upon a career in the environmental sciences and forestry may enter as either freshmen, directly from high school, or as sophomores and juniors, having spent one or two years at other colleges and universities.

For nearly 80 years, the full thrust of the State University of New York College of Environmental Science and Forestry has been focused on the environment on all of its six campuses and in each of its three mission areas—instruction, research, and public service. The College has been, and continues to be, devoted to the advancement of environmental science and forestry.



The Mission: Instruction, Research, and Public Service

INSTRUCTION

In the fall of 1989, student enrollment reached 1,569. Of this number, 942 were undergraduates and 627 were graduate students. In addition, there were 10 students engaged in postdoctoral work.

Undergraduate Education

At the baccalaureate level, the College offers professional study in eight areas: *chemistry; environmental and forest biology; environmental studies; forest engineering; paper science and engineering; wood products engineering; resource management;* and *landscape architecture.* These programs are registered with the New York State Education Department.

Each of these curricula leads to the bachelor of science degree. In the case of landscape architecture, which is a five-year program, a bachelor of landscape architecture degree is awarded. In the forest engineering program, a fifth year leading to a bachelor's degree in civil engineering can be taken at Syracuse University or State University at Buffalo.

Technical Education. At the paraprofessional level, the College has been training forest technicians since 1912 at its Wanakena Campus in the Adirondack Mountains. It is the oldest Ranger School in the United States and offers a two-year *forest technology* curriculum. Graduates are awarded an associate in applied science degree. In this curriculum, students take their first year of general education at a two- or four-year college. The second year, with its emphasis on practical field training in the relationships between forest technology and managerial needs, is taken at Wanakena with its 2,800 acres of forested land. Graduates of this degree program in practical forestry are prepared for positions as forest rangers; federal, state, and private industry forest technicians and forestry aides; district forest supervisors; timber inventory specialists; timber sales supervisors; forest surveyors and engineering aides; and forest protection technicians.

SCIENCE TEACHER CERTIFICATION

ESF, in cooperation with the School of Education at Syracuse University, provides the opportunity for selected undergraduate students to prepare for New York State provisional science teacher certification. Transfer students who maintained a 3.000 or greater cumulative grade point average at their pre-ESF institution or who earned a 2.500 grade point average or greater during their first semester at ESF are eligible for acceptance into the program. To receive provisional certification to teach secondary (grades 7 through 12) science in New York State, students must complete the following requirements.

1. A minimum of 36 credit hours in science (both lower and upper division courses), including
2. 24 credit hours in each science for which certification is sought (Only biology and chemistry may be certified through this program, however, if students have taken at least 24 credits in physics or earth science independent of ESF, they can also be certified in these areas. Certification for teaching general science will be included when the total shows college-level study in at least two sciences.), and
3. 21 credit hours in education at S.U. distributed as follows:

EDU 207 Study of Teaching (Secondary)	3
EDU 307 Personalizing Teaching and Learning	3
EDU 308 Strategies of Teaching (Secondary)	3
SCE 535 Practicum in Methods Science Teaching	3
EDU 508 Student Teaching	9
	21

EDU 308, SCE 535, and EDU 508 are normally taken together as a block in the fall of the senior year, with SCE 535 and EDU 308 meeting for the first half of the semester and EDU 508 meeting the second half. EDU 508 is a full-time commitment for about ten weeks, so other courses must be scheduled with this in mind. SCE 535 is normally offered only in the fall.

4. New York State also requires successful completion of the National Teacher Examination (NTE) for provisional certification.

ESF students who complete these requirements may then apply through the School of Education at Syracuse University to the State Education Department for provisional certification.

A few certification requirements will be in effect for those students who will receive their degree after September 1, 1993.

Graduate Education

The College awarded its first graduate degree in 1913. Today the College offers advanced degrees in six major program areas: *environmental and forest biology; forest chemistry; forest resources management; forest management and operations; environmental and resource engineering; landscape architecture;* and *environmental science.* These programs are registered with the New York State Education Department.

Graduate study leads to the master of science degree, master of forestry degree, the master of landscape architecture degree, and the doctor of philosophy degree. A postdoctoral study program, closely related to the College's research effort, is also available.

CONCURRENT GRADUATE DEGREES

ESF and Syracuse University provide the opportunity for graduate students to complete concurrently a degree at ESF and at Syracuse University in either the M.P.A. degree in the Maxwell School of Citizenship and Public Affairs, the M.A. or M.S. degree in the S.I. Newhouse School of Public Communications, the M.S. degree in the School of Education, or the M.B.A. degree in the School of Management. Students must complete at least one semester of graduate level coursework and earn a 3.500 or greater grade point average at ESF before being considered for a concurrent degree program at Syracuse University. At the completion of the first year of law school, students at the Syracuse University College of Law may apply for admission to a concurrent degree program at ESF.

COLLEGE OF AGRICULTURE AND LIFE SCIENCES AT CORNELL UNIVERSITY

The State University of New York College of Environmental Science and Forestry and the New York State College of Agriculture and Life Sciences at Cornell University provide an opportunity to exchange graduate students so they can take advantage of special courses, faculty, and research facilities.

THE OFFICE OF CONTINUING EDUCATION

No one is educated for life anymore; education is now a lifelong pursuit. More people every year find they must return to the classroom for professional upgrading, retraining, and personal enrichment.

We live in an age where information and technological advancement are replacing industrial goods as the major products. It is more urgent than ever that continuous education, technological transfer, and retraining are made available to everyone.

ESF Mission. Since its inception, the College of Environmental Science and Forestry has held public service to be one of its most important missions. This mission was reaffirmed and strengthened during the 75th Anniversary of the College in 1987. The College offers learning experiences in a wide variety of formats through its Office of Continuing Education. Expanding programs serve new groups, and reach out further to those with learning needs. Inquiries about these developments are welcomed in the Office of Continuing Education.

Serving New York Citizens. The learning needs of New York citizens reflect the interdependent trends of our changing times. As research and education lead to an increasingly technological society, growing sophistication increases concerns for a safe environment. As urbanization continues, use and ownership of our agricultural and forest lands depart from traditional patterns. As increased leisure and travel swell the demand for recreational facilities, multiplying recreational activities create competing uses of our lands and waters. As New York strives to balance natural resource utilization with environmental protection, the need grows for educational opportunities in environmental science and forestry for both professional and general adult audiences.

CONTINUING PROFESSIONAL EDUCATION

The Office of Continuing Education at ESF extends the research and knowledge base of the College to the greater community at large. Credit courses, shortcourses, symposia, and seminars on all subjects related to the ESF curriculum are presented to a wide variety of audiences.

Working in cooperation with government agencies at all levels, professional groups, and representatives of business and industry, the Office of Continuing Education provides the opportunity for the latest in professional education. Courses are designed at the theoretical and applied, basic and advanced levels.

Audiences include environmental professionals, forest owners, managers, and operators; scientists and researchers; wood and construction engineers, paper products manufacturers and researchers; conservation and recreation personnel; wildlife managers; landscape architects and local and regional planners; and citizen action committees. ESF courses include participants from both the public and private sectors with local, regional, and national representation.

Upon request, continuing education programs are designed to meet the specific learning needs of professional organizations, community groups, and industry. Credit or noncredit courses, at campus or off-campus sites, are arranged. These courses have various formats to meet the requirements of busy and engaged adults. Shortcourses, seminars and symposia vary in length from part of a day to a full semester. Inquiries are invited.

COMMUNITY EDUCATION

Continuing Education also means personal enrichment for the community. The unique expertise of the College faculty is extended to the community through public shortcourses, lecture series, and forums. Members of the community are invited to make recommendations for continuing education activity at any time.

Conference Services. SUNY ESF provides conference services for meetings of professional associations, technical and academic societies, government, industry, environmental and community organizations, and other groups whose interests correspond with the mission of the College. The Office of Continuing Education has coordinated programs ranging from small seminars to week-long international meetings in an urban university environment and in rustic, retreat settings.

The College of Environmental Science and Forestry can provide meeting facilities for groups of up to 450. Through its ties with Syracuse University and area hotel convention sites, even groups of 2,000 or more can be accommodated. The complete range of conference services, from meeting rooms and audio-visual services, to lodging and catering, is available. The College's regional campuses in the Adirondacks, at Wanakena, Newcomb, and Warrensburg, and in western New York, at Allegany State Park, also provide attractive sites for conference events. Inquiries about facilities, services, and costs are invited.

Nonmatriculated Students. All of the credit courses offered at the College of Environmental Science and Forestry are available to students not enrolled in a degree program. By enrolling through the Office of Continuing Education, a student may earn credit toward a degree at another college or university, develop the prerequisites necessary to enter more advanced courses at ESF or elsewhere, or sample courses as an aid to determining which major in which to enroll. Registration for credit courses as a nondegree student is through the Office of Continuing Education.

Inquiries. For information on specific continuing education activities, inquiries should be sent to the Office of Continuing Education, 218 Bray Hall. Telephone inquiries may be made at (315) 470-6891.

PUBLIC SERVICE

The College, throughout its almost 80-year history, has continued to respond to its specific legislative mission in the area of public service. Community education and information, technical advice and guidance to cooperating local, state, and federal agencies and organizations, and technical assistance to the forest and wood-using industries constitute the principal formal public service activities.

While the list of public service contributions is lengthy, a few examples include: the College's Film Library; the Tree Pest and Disease Service, which provides technical advice to private citizens and to governmental agencies; and the participation of ESF faculty members in Central New York's Poison Control Center. Altogether, the public service programs of the College reach approximately one million New York State residents each year.

RESEARCH

The College's commitment to scientific inquiry stretches far back to its second year of existence. In 1912, Dean Hugh P. Baker initiated the first research project of the College by joining forces with the U.S. Forest Service in an industry study designed to show what kinds of firms were using wood in New York State and the species and quantities used.

The College's research program has attracted a worldwide clientele of industrial, governmental, professional and scientific groups, and through liaison with them, the program maintains its vigor and relevancy to the important environmental issues. Support from this clientele amounts to more than $4.5 million a year.

Students and faculty from across the College contribute to the depth and diversity of the research program. Findings from these studies are applied to a host of issues and problems through various demonstrations and information devices. Recent examples include studies of the impact of acid precipitation on forest ecosystems; the restoration of the lynx in the Adirondack Mountains of New York; the development of a system for integrating wildlife with forest management; the natural production of migratory fish in lakes and streams; the development of a forest resource management and planning support system; new wood pulping and bleaching processes leading to pollution-free water and air effluents; the development of polymeric materials for artificial human organs; and the evaluation of a radio-frequency drying method for lumber.

Empire State Paper Research Institute

The Empire State Paper Research Institute (ESPRI) is a worldwide research organization in the pulp and paper field. It performs investigations in cooperation with the Empire State Paper Research Associates (ESPRA), which is comprised of 72 pulp and paper companies in 14 countries. The Institute was established in 1945 when the members of ESPRA recognized the need for new scientific and technical knowledge and methods, and since then ESPRI has been able to maintain an efficient balance between the practical and theoretical bases of the pulp and paper industry.

Housed in the modern J. Henry Walters Hall with its own pilot paper mill, and staffed by scientists who are internationally recognized for their accomplishments, ESPRI provides a research base for long-range industry development. Its program has widened in scope to cover almost all aspects of pulping and papermaking, including additive retention, oxygen pulping and bleaching, effluent control, sheet drying, printability, and energy efficiencies.

Polymer Research Institute

Scientists at the College have made many original contributions to the field of pure and applied polymer chemistry, including the development of living polymers, the study of anionic polymerization and electron-transfer initiation, and work on the permeation of gases and films through polymeric films.

College faculty specializing in polymer chemistry have trained hundreds of graduates and postdoctoral researchers, many of whom now hold leading positions in universities and industrial and governmental laboratories.

N. C. Brown Center for Ultrastructure Studies

This Center, located in Baker Laboratory, is a teaching, research, and service facility of the College. It is equipped to provide students, faculty, and research staff with virtually every type of modern microscopy. This includes light microscopy, video microscopy, scanning electron microscopy, and transmission electron microscopy.

Among the major items of equipment in the Center are: a JEOL 2000EX 200-KV transmission electron microscope; an RCA EMU-4A transmission electron microscope; two ETEC Autoscan scanning electron microscopes with energy dispersive x-ray analyzer, wavelength x-ray analyzer, LeMont Scientific Image Analysis System, and microstages for mechanical testing of specimens within the scanning microscope chamber; high vacuum evaporators; microtomes; ultramicrotomes; and an array of specialized light microscopes including a high resolution enhanced contrast video microscopy system.

The Center's resources include specimen preparation rooms, several photographic darkrooms, three electron microscope laboratories and other supporting facilities.

The primary service of the Center is teaching; course offerings include microscopy and photomicrography, scanning electron microscopy, transmission electron microscopy and interpretation of ultrastructure. Research is a second major activity and the Center provides support to students, faculty and research staff who have projects involving structural studies. Public service is extended to industry, regional medical facilities and colleges as well as to local high school groups and technology-oriented organizations.

Adirondack Ecological Center

The Adirondack Ecological Center (AEC) is located on the Huntington Wildlife Forest in the geographic center of the 6-million-acre Adirondack wilderness. The AEC provides a support base for ecological research in the region, including housing, laboratory, computer, and library facilities. A resident staff maintains an extensive historical database and conducts continuous monitoring of environmental variables, such as weather and atmospheric chemistry, vegetation, and wildlife populations. Currently, more than 100 students and scientists are conducting research, ranging from the effects of acid precipitation on tree growth to restoration of the moose and lynx in the Adirondack region. Most research is conducted by graduate students, but undergraduates are encouraged to become involved as seasonal field assistants. Approximately 40 students are in residence at various times throughout the year. The Huntington Wildlife Forest, a 15,000-acre property owned by the College, provides an exceptional resource for experimentation in ecology and natural resources management. Rich Lake, on the Huntington Wildlife Forest, is the site of the new Adirondack Interpretive Center, a $1 million facility operated by the Adirondack Park Agency and open to the public throughout the year.

Great Lakes Research Consortium

The Great Lakes Research Consortium (GLRC) involves eight educational institutions in a collaborative effort to understand and improve the Great Lakes ecosystem in New York State. Headquarted at ESF, the Consortium's other member institutions are SUNY Colleges at Brockport, Oswego, and Buffalo; the SUNY Centers at Buffalo and Albany; and Clarkson and Cornell universities. Also participating are six affiliated universities in the province of Ontario, Canada.

Goals of the Consortium are the facilitation of research and scholarship involving Great Lakes issues, the education of students on topics related to the Great Lakes ecosystem, and the dissemination of information gathered through Consortium-sponsored research. The GLRC sponsors scholarly workshops, a cooperative grants program, a seminar series, a database of New York Great Lakes scientific and scholarly work, and a newsletter.

Tropical Timber Information Center

The Tropical Timber Information Center (TTIC) provides identification of wood samples and information about tropical woods for both general characteristics and technical properties. These services are oriented toward importers and users of tropical woods. The Center began operation in 1975 as part of the Department of Wood Products Engineering and is one of only two such sources of information in the western hemisphere. The Center also carries out special studies under contract for production of data that is not available in the literature. The technical base for operation of the Center is a large, worldwide collection of authenticated wood samples and an extensive collection of reference materials in Moon Library and the Faculty of Wood Products Engineering. Both of these resources have been built up over the past 60 years by close cooperation with institutions throughout the world. Activity is oriented toward requests for services from importers and users of tropical woods and to expanding the collections.

The New York State Center for Hazardous Waste Management

The College is named in New York State legislation as a partner in the New York State Center for Hazardous Waste Management which is centered at SUNY Buffalo. Long-term research and development goals of the Center include developing cost-effective technologies for neutralizing, recycling, or otherwise securely containing hazardous substances, and developing improved methods of safely storing and transporting toxic substances. ESF faculty and staff represent an interdisciplinary group with expertise in areas including biochemical toxicology, microbiology,

environmental chemistry, sludge management, microbial ecology, and implementation considerations including engineering and management components.

Cellulose Research Institute

Research at the Cellulose Research Institute is at present centered on the fine structure of native cellulose and its transformations into other commercially important forms of cellulose. For example, the structural differences between native and regenerated celluloses have been determined, for the first time, through x-ray crystallographic studies. The same techniques are now being used to study the structural aspects of cellulose mercerization, an important commercial process in cellulose chemistry. Other recent research has been concerned with the organization, chemical composition, and function of the vascular cambium in trees, the ultimate source of all wood and bark produced in nature.

U.S. Department of Agriculture—Forest Service Cooperative Research Unit

The Northeastern Forest Experiment Station of the U.S. Department of Agriculture-Forest Service maintains a research center at the College. Until 1977, this unit pursued studies of forest-centered recreation with the aim of developing methods for integrating recreation and other uses of forests.

Beginning in 1978, the Cooperative Research Unit was re-oriented to research on urban environmental forestry problems. This provides increased opportunities for faculty and students to collaborate with Forest Service scientists in studies of urban and environmental problems.

Graduate Education and Research Initiative

Governor Mario Cuomo and the New York State Legislature have supported the Graduate Education and Research Initiative (GERI) designed "to retain and attract premier faculty and graduate students, secure outside governmental and corporate support, and develop a university climate that spawns creativity."

To maximize the return on the state's contribution, SUNY's eight doctoral-granting campuses each have identified those centers of excellence or targets of opportunity in which they can make the most significant advances in research and graduate education and which hold the greatest potential for attracting additional resources to the State of New York. By focusing limited funds on carefully selected centers of excellence, the participating institutions maximize their contributions to the achievement of the Initiative's broader goals while remaining responsive to the needs of the specific regions they serve.

ESF has advanced four programmatic themes: Biotechnology in Forestry, Environmental Systems Science, Process Engineering, and Polymer Science and Technology.

BIOTECHNOLOGY IN FORESTRY

The Biotechnology in Forestry initiative is committed to pursue excellence in graduate education and research and to forge linkages with industries and governmental agencies concerned with forest biotechnology. This multidisciplinary effort is based on the faculty in four major graduate programs: Environmental and Forest Biology, Forest Chemistry, Forestry, and Environmental and Resource Engineering. An overall objective is to develop practical research to help meet state and national needs in forestry and forest product utilization. An integrated five-year B.S./M.S. Specialization in Plant Biotechnology in the Environmental and Forest Biology Graduate Program or an M.S. in one of the four graduate programs or a related discipline can be followed by a Ph.D. program. Graduate research assistantships are available for outstanding students in this area of study.

Research and its applications are focused on plant molecular biology; plant and pest interactions including fungi, bacteria, viruses, mycoplasma-like organisms (MLO's), and insects; biomass and xenobiotic conversions; and forest products and productivity. The expertise in molecular biology of new faculty complement current areas of strength and provide depth for molecular approaches to basic and applied research. Areas of research include: molecular taxonomy; transformations of trees and fungi; multicopy gene variability; molecular ecology and chemical messengers; molecular biology of fungi; construction of DNA vectors; fungal dsRNA and pheromones in biological control; *in vitro* selection for disease resistance; mechanisms of pathogenicity and disease resistance and their genetic control; tissue, shoot, protoplast and single cell culture; bioconversion of lignocellulose and hemicelluloses; enzymatic photostabilization of paper pulp; microbial detoxification of hazardous wastes; trace metal metabolism by phytoplankton; microbial treatment of wastewater; selection and breeding for wood quality, growth rate, and disease resistance.

Facilities include newly remodeled and equipped molecular biology research and teaching laboratories, tissue culture clean room, controlled environment chambers, modern glasshouses including three air-conditioned units, NMR and GC-mass spectrometers, HPLC's, fermentation systems, radioisotope and ultrastructure laboratories. Access to the cell sorter and DNA and peptide synthesizers and sequencers at Syracuse University is also available.

ENVIRONMENTAL SYSTEMS SCIENCE

Environmental Systems Science is the quantitative and integrative study of physical, chemical, biological, and social-economic processes and mechanisms applied to ecosystems. It is integrative because it draws from faculty and research activity in the Faculties of Chemistry, Environmental and Forest Biology, Environmental Studies, Forest Engineering, and Forestry.

The approach of **Chemistry** to environmental systems science emphasizes interactions between environmental processes and chemical elements and species in environmental systems. Current studies include behavior of trace organic contaminants in the Great Lakes, trace metal uptake by phytoplankton, characterization of natural organic compounds in water, identification and characterization of air and water particles, and development of improved sampling and analytic methods for air and water.

Environmental and Forest Biology (EFB) stresses ecosystem analysis and modeling. EFB's diverse faculty has particular strengths within the northern hardwood forests, tropical forests, temperate and tropical rivers, lakes and wetland ecosystems. Specific research projects related to systems ecology include: nutrient flows in Adirondack ecosystems, changing tree species dynamics related to changing patterns of climate, precipitation chemistry and pathogens, long-term ecological research on disturbance and recovery in the Caribbean National Forest, phosphorus dynamics linking rivers and lakes in both upstate New York and Montana, procedures for enhancing the recovery from disturbance of ecosystems in both the Adirondacks and in India.

The approach of **Environmental Studies** to environmental systems science stresses sustainable development as a basic concept, environmental information systems as a means for organizing environmental data, and environmental program analysis as a critical review of environmental policy programs. Current research revolves around international applications of integrated environmental planning, wetland systems assessment and evaluation, cross-cultural environmental perception, and environmental information system utilization and accuracy.

The approach of **Forest Engineering** to environmental systems science emphasizes hydrology and water resources (including wastewater engineering) and geospatial modeling and analysis. Current research activity is focused on remote sensing, digital image measurements, air photo analysis, water quality analysis, modeling and treatment, and solid/hazardous waste systems analysis and treatment.

Forestry stresses resources information management, forest growth modeling and silviculture, forestry economics and policy analysis, and urban greenspace systems ecology. Current research includes forest soil and site productivity, remote sensing and Geographic Information Systems (GIS) application to forest management; exurban, urban and wildland-urban interface management and silviculture, and effects of acidic deposition on forest soils.

PROCESS ENGINEERING

Serving as the bridge between science and technology, process engineering creates practical applications from scientific discoveries, providing the means for converting material resources into useful products. Design, control and optimization of manufacturing units and systems are key elements of process engineering, with increasing attention to energy efficiency and waste reduction, and extensive use of computer simulation both in research and practice.

At ESF, activity in process engineering is centered in the Division of Engineering and is strengthened by long-standing ties with forest products industries through units such as the Empire State Paper Research Institute. But it relates closely to all of the Faculties and Institutes of the College, and process engineering links and stimulates the applied aspects of the other three specialties in the GERI program. As this program progresses, ESF aims to become a major center of education and research in process engineering.

POLYMER SCIENCE AND TECHNOLOGY

The Polymer Research Institute (PRI), a SUNY-wide polymer research center located in the Faculty of Chemistry, provides the site, resources, and program for scientific research in which graduate students conduct their experimental studies and the Chemistry Faculty of PRI supervise the graduate education for M.S. and Ph.D. degrees.

Research areas in polymer science that are available in PRI and are supported by GERI, include: ion-conducting polymers (polymer electrolytes), functionalized polysiloxanes, X-ray contrast polymers, and ring-opening polymerizations of cyclic siloxanes; theoretical studies on elastomers and polymer rubbery state, theory of stress-induced crystallization; new methods of polymer synthesis, stepwise polymerization, synthesis of temperature stable polymers; polymer blends, alloys, and solid phase multicomponent miscible systems; polymer membranes for gas and liquid separations.

Also studied are the structure, morphology and dynamics of polysaccharides by diffraction analysis and molecular modeling; use of solid-state NMR methods studying both the static and dynamic aspects of polymer structure and, ultimately, the interrelation of structure in solid and liquid phases, and the production and characterization of microbial-origin biopolymers; and enzymatic corrosions of biomass to useful products.

The Campuses

The College operates a multiple campus system with regional campuses and field stations located at Syracuse, Tully, Wanakena, Warrensburg, Cranberry Lake, Newcomb, and Clayton. This system is composed of about one million square feet of facilities in 186 buildings on 25,000 acres of land.

THE SYRACUSE CAMPUS

The main campus is in Syracuse and lies on 12 acres adjacent to Syracuse University in an area that traditionally has been known as "The Hill." Located here are the principal instructional programs at the bachelor's, master's, and doctoral levels. In addition, the main campus houses the Empire State Paper Research Institute, the Polymer Research Institute, a cooperative research unit of the USDA Forest Service and the Ultrastructure Center.

These program units are housed in five major academic buildings (Baker Laboratory, and Walters, Bray, Marshall, and Illick Halls). The main campus also includes Moon Memorial Library, the Maintenance Building, and several other small service and storage facilities.

Specialized facilities at the Syracuse campus include electron microscopes, plant growth chambers, air-conditioned greenhouses, a bio-acoustical laboratory, a 1,000-curie cobalt-60 radiation source, radioisotope laboratory, computing center, and specialized instrumentation including a new 300 MHz nuclear magnetic resonance spectrometer with both liquids and solids capability, electron spin resonance spectrometer, gas chromotography, mass spectrometer, ultracentrifuge, and X-ray and infrared spectrophotometer. The Mapping Science Laboratory operated by the Faculty of Forest Engineering has an extensive array of equipment. The capabilities of this laboratory include full-featured image processing, a full range of optical/mechanical and analytical photogrammetry instruments, extensive equipment for image interpretation, sensor and atmospheric modeling systems, photographic acquisition and processing, many different GIS systems and extensive surveying capacity. The paper science and engineering laboratory has a semicommercial paper mill with accessory equipment. The wood products engineering department has a complete strength-of-materials laboratory as well as a pilot scale plywood laboratory and a machining laboratory. The greenhouses and forest insectary are used to produce plant and insect material for classroom and laboratory. Extensive collections are available for study, including wood samples from all over the world, botanical materials, insects, birds, mammals, and fishes.

The environment is inherently spatial (geographic). Better consideration of spatial relationships and characteristics will revolutionize understanding and management of environmental processes and conditions. Modern technology, especially in computing and information management, is now providing the tools necessary for this improved understanding. Specifically, **Geographic Information Systems (GIS)** provide the powerful tools needed for a coordinated, cross-disciplinary effort in "Geo-spatial Modeling and Analysis" (GMA).

Geographic Information Systems are collections of capabilities for acquiring, storing, managing, manipulating, analyzing, displaying, and reporting data or information which has locational or spatial attributes. ESF recognizes the power and utility of GIS for generating fundamental knowledge about the environment and for many practical environmental applications. These environmental topics cover the breadth of programs at ESF, including: natural resources management; environmental and biological science; local and regional planning; engineering; and design of facilities and sites.

GMA instruction and research at ESF builds upon existing strengths in mapping science and engineering (surveying, photogrammetry, remote sensing, hydrology, environmental engineering, waste management) and environmental applications (environmental science, natural resources management, planning, and design). Extensive research and advanced instruction facilities are located in the Mapping Science Laboratory and the Environmental Design, Planning, and Visual Simulation Laboratory. These facilities continue to expand through support by SUNY, applications research, standard and continuing education programs, and special funding. Additional resources exist at other facilities at ESF and Syracuse University, including the Advanced Graphics Research Laboratory and an internationally recognized faculty in the areas of cartographic theory and geographic analysis. The expertise and extensive facilities at ESF for spatial analysis continue to be renowned within disciplines related to environmental science, management, and design.

Any program at ESF can include a component of GIS instruction and practice with proper coordination. In addition, much more concentrated study, application, and research using GIS is available through the following graduate programs.

Division of Engineering. Interests are in spatial data acquisition, environmental database development, environmental modeling, site selection, and facility design.

GIS study in engineering may be coordinated with programs in photogrammetry and mapping, environmental assessment and engineering, image processing, and water resources.

Environmental Studies. Interests are in policy issues associated with environmental information, and applications within metropolitan environments. Both the graduate and undergraduate programs offer students special opportunities to pursue an interdisciplinary program that is tailored to their needs.

Forestry. Interests focus on forest management and planning and range from inventory analysis through harvest planning to general multiple use forest management. Since resources management is essentially spatial in nature, both the undergraduate program in Resources Management and the two graduate programs (Forest Resources Management and Forest Management and Operations) benefit from this technology.

Landscape Architecture. Interests include the application of CAD, GIS, and Video technologies for landscape analysis, planning, and design. These technologies are integrated into both undergraduate and graduate required coursework, and advanced B.L.A. and M.L.A. students may pursue additional specialized learning in computer applications.

The **F. Franklin Moon Library** and **Learning Resources Center** contains more than 95,000 cataloged items and over 900 journals are currently received. The collection constitutes a specialized information source for the forestry, environmental science, and landscape architecture programs of the college, and it has concentrations in such areas as botany and plant pathology, biochemistry, chemical ecology, forest chemistry, polymer chemistry, economics, entomology, environmental studies, landscape architecture, environmental design, management, paper science and engineering, photogrammetry, silviculture soil science, water resources, world forestry, wildlife biology, wood products engineering, and zoology.

The collections of Syracuse University libraries (SU's Science and Technology Library is immediately adjacent to the ESF campus), and SUNY Health Science Center at Syracuse are within walking distance. These libraries may be used by all members of the College of Environmental Science and Forestry. Other collections located throughout New York State and the United States are readily accessible through inter-library loan. All Syracuse University collections may be searched by using the public access online catalog located in Moon Library.

The library building opened for service in 1968 and can seat 575 persons. The main reading areas are located on the upper level adjacent to the open stacks and are divided by the card catalog and reference service area. The library contains a current periodical room, a bibliographic center containing indexes and abstracts, individual study carrels and library faculty offices. The Hoverter Archives and special collections, conference room, audio tutorial center, and computer terminal room are located on the lower level.

The archives consists of historical items relevant to the college and forestry development in New York State. The special collections area of the archives contains rare, scarce, and valuable books, and folios as well as the Fletcher Steele collection on landscape architecture, and the Thomas Cook collection on papermaking.

Public services provided by the library faculty includes a credit course, orientation, class lectures, study guides, user aids, and reference desk service. Moon Library is a member of the SUNY OCLC network.

The **Instructional Services** unit of the **Learning Resources Center** directly supports the program areas of the College through instructional development and application of media materials and instruction for the classroom, for the presentation of research findings, and for public service endeavors. These include television programming, slide/tape and motion picture production and photographic services. Other services to the College community include engineering, audio-visual equipment distribution, and maintenance and support functions. The Instructional Services staff also participates directly and actively in instructional programs in environmental communication at both the undergraduate and graduate levels.

The College provides **academic computing services** in several forms. Public clusters of microcomputers are maintained as combinations of open-shop/classroom facilities for general collegewide use. One of the clusters contains 15 Macintosh SE's and 15 IBM PS/2-50's networked together for high-level local use of both simple and sophisticated software, and for communication to external hosts as needed. One public cluster contains a total of 16 VDT and four KSR terminals connected at 9600 bps to a network of mainframe computers at Syracuse University. Other clusters contain microcomputers for specialized uses such as graphics and geographic information systems. Semi-public clusters of microcomputers and terminals are also provided in each of the academic buildings on the main campus and at some of the field campuses.

The host systems on the Syracuse University network (SUACS) which are accessible to ESF consist of an IBM 3090/150, and a mixture of DEC VAX configurations. Using SUACS as a hub, ESF has access to external networks such as NYSERNET, BITNET, and FASTNET.

THE TULLY CAMPUS

Located about 25 miles south of Syracuse is the Tully Campus which is composed of the Heiberg Memorial Forest and the Genetic Field Station.

Heiberg Memorial Forest is located on the northern escarpment of the Allegheny Plateau. It includes 3,800 acres of diverse terrain and forest growth. The Forest is utilized both as an extensive outdoor teaching laboratory and as a site for intensive research. The **Forest Ecosystem Lab**, which is a highly instrumented outdoor teaching laboratory, a large complex of all-weather classrooms, many experimental plantings from throughout the world, and a commercial-scale maple syrup operation are among the developments on this forest. Each fall the Heiberg Memorial Forest is the site of an intensive program for environmental and resource management students in a total ecosystem approach to forest community management instruction.

THE WANAKENA CAMPUS

The Wanakena Campus, located on the Oswegatchie River, 65 miles northeast of Watertown and 35 miles west of Tupper Lake, is the site of the **James F. Dubuar Forest** and the **Faculty of Forestry's Forest Technology Program.** This campus, with its large instructional and demonstration forest of 2,800 acres, supports the College's associate degree program for the training of forest technicians. This is the oldest forest technician school in the country. This campus is situated on the western plateau of the "lakes region" of the Adirondacks.

Beginning this year, the Wanakena Campus will host the Summer Session in Field Forestry, a seven-week course devoted to introductory instruction in field forestry principles and techniques. The course is required of all entering students in Environmental and Resource Management and is open to election by students in Environmental and Forest Biology.

THE WARRENSBURG CAMPUS

The Warrensburg Campus is located in the southeastern Adirondack region and encompasses the **Charles Lathrop Pack Demonstration Forest,** an area of roughly 2,800 acres of heavily forested land noted for its white pine. The Forest has been under intensive management since 1927 for the combined purpose of instruction, research, and demonstration in forestry and allied fields.

Formal offerings in Continuing Education and various meetings and conferences are also held here for practicing professionals and organizations directly associated with forestry and allied environmental fields.

THE CRANBERRY LAKE CAMPUS

The Cranberry Lake Campus, approximately 1,000 acres of forested property situated in the northwestern section of the Adirondack Mountains of northern New York State, is the site of the College's **Biological Station** where the College operates an eight-week summer field program in environmental biology. The campus is bounded by 150,000 acres of New York State forest preserve lands, by Cranberry Lake and by isolated forest bogs and beaver meadows.

The extensive facilities are intensely utilized in a comprehensive curriculum of upper-level and graduate courses.

Use of this campus before and after the summer session program varies to include individual research projects, cooperative studies with other agencies and visits by large groups from both the College and outside institutions.

THE NEWCOMB CAMPUS

Located in the central Adirondack Mountains, Newcomb is the largest of the regional campuses and home to the **Adirondack Ecological Center** where extensive studies of animal biology and ecology are carried out. Also located there is **The Archer and Anna Huntington Wildlife Forest** which is about 15,000 acres in size.

This campus is of mountainous terrain and contains a variety of vegetative types and wildlife. The campus is used year round for a general research and forest management program participated in by faculty, graduate students, and visiting scientists.

THE FIELD STATIONS

In addition to its regional campus system, the College operates several field stations which directly support the instruction, research, and public service programs of the institution. The 44-acre **Forest Experiment Station,** located only a few minutes' drive from the main campus in Syracuse, is used to support main campus academic programs. Located at the Station are a large arboretum, tree nursery, and experimental greenhouse facility. Adjacent to the Tully Campus is the College's **Genetic Field Station**. It is a 59-acre area devoted to relatively short-term outplantings of plant materials developed in the various genetic research projects of the College. With its irrigation system and layout of level blocks, it is an excellent facility for developing hybrids, for grafting, doing experiments, and for research in heritability. A magnificent island, the **Ellis International Laboratory,** is situated in the heart of the Thousand Islands-St. Lawrence River area off the village of Clayton. Accessible only by boat, this laboratory is an unusually appropriate site for the Collegewide, cooperative and international, environmental monitoring and research activities of the St. Lawrence Seaway area. The College's most recent acquisition is a 15.2-acre facility on **Wellesley Island.** This island property, formerly a Coast Guard Station, has shore frontage on the American channel of the St. Lawrence Seaway. It is ideally suited for aquatic studies of many types.

The Syracuse Metropolitan Area

The College of Environmental Science and Forestry is located on one of several hills that overlook Syracuse, a growing metropolitan area of nearly 500,000. Known as the "Salt City" because of the great salt industry which was centered here for more than seventy years, Syracuse is today a city of diversified industry and commerce. The area is a leader in the manufacture of china, air conditioning equipment, medical diagnostic equipment, drugs, automotive parts, and lighting equipment.

The City of Syracuse offers students many cultural, recreational, and educational opportunities, including a symphony orchestra, several museums, live theater, and historical points of interest.

Called the "Crossroads of New York State," Syracuse is one of the few cities in the nation situated at the crossing point of two major superhighways. It is located at the intersection of the 500-mile east-west New York State Thruway and the north-south Penn-Can Highway. Driving time from New York City, Philadelphia, Boston, Toronto, and Montreal is about five hours; from Buffalo and Albany about three hours. The city is served also by a modern international airport and major bus and rail lines.

Academic Life

Society is increasingly in the hands of those who have broad foresight and a balance of judgment in applying scientific, sociological, and technical knowledge to guide human and environmental forces. Modern civilization—with its compelling demands from industry, government, and educational institutions—requires people who think objectively and constructively, and who act creatively and responsibly.

From its beginnings in 1911, the State University of New York College of Environmental Science and Forestry has served New York State and the nation in meeting the needs of its citizens in regard to the environment through education, research, and public service. The faculty and students of the institution are committed to the resolution of immediate environmental problems, the development of the knowledge necessary to predict occurrences in the future, and the presentation of public policy alternatives that will both protect the environment and accommodate the real needs of society.

At the undergraduate level, ESF offers curricula in the general areas of resource management, engineering, environmental design, and the physical and life sciences that prepare graduates to enter and contribute to the professional world or to continuing their education at the graduate level, at ESF or elsewhere.

Graduate years are a time of discovery and excitement, a time of answers and new insights, a time of personal productivity and contributions to scholarship. It is during graduate education that the student sharpens the ability to think critically and analytically, to plan research to design experiments, to work effectively with the basic research tools as well as specialized equipment, and to undertake the discipline of purposeful study toward a specific goal.

The College currently supports significant graduate degree programs in five discipline areas and in its broad program in Environmental Science, which encourages multidisciplinary study. Both undergraduate and graduate programs of the College reflect the work of its faculty and their student colleagues, who, together, utilizing some of the most modern facilities and laboratories in the country, maintain a long-standing tradition of academic and professional excellence.

This catalog provides an introduction to the College and its programs of undergraduate and graduate study and research. It only begins to suggest the diversity and depth of the existing and potential programs that make environmental science the challenge of the late 1990's and beyond.

UNDERGRADUATE ADMISSIONS

Renowned for its undergraduate instruction and unique teaching facilities, ESF enrolls well-qualified students at either the freshman, sophomore or junior level. Acceptance at each level depends on several factors, including: major selected, previous academic preparation as well as personal motivation and interest in ESF.

All students considering applying to ESF are expected to follow the prescribed set of prerequisite courses appropriate to their intended major at the College. Each curriculum offered at the College of Environmental Science and Forestry and listed in this catalog defines the required courses necessary to be considered for admission.

For transfer students, it is expected that courses taken at other colleges will be completed at institutions that are accredited by one of the six regional accrediting agencies, e.g., Middle States Association of Colleges and Schools, Southern Association of Colleges and Schools. Credit received by testing must be from one of the standardized testing agencies, e.g., College Board, College Level Examination Program.

APPLYING FOR ADMISSION

Applications for the College of Environmental Science and Forestry are available in all New York State high schools and other SUNY admissions offices. You may also request an application package from the ESF Office of Undergraduate Admissions.

Students are admitted to ESF by one of four different methods: 1) Freshman Admissions, 2) Advanced Early Admissions, 3) Transfer Admissions, 4) Deferred Admissions. Each of these entry points requires the applicant to have a specific academic background and to have maintained a satisfactory grade point average.

FRESHMAN ADMISSIONS

The College enrolls a limited number of students directly from high school. This *Freshman* enrollment option is available for students who meet admissions standards and select one of the following majors: Environmental and Forest Biology, Resources Management (General Forestry), the Dual Program (combines Biology and Forestry), Chemistry, Paper Science and Engineering or Forest Engineering.

Successful freshman applicants should present the strongest academic credentials from high school including four units of each in mathematics and science (including at least chemistry or physics). Applicants are also expected to forward the results of either the SAT or ACT examination. The achievement tests for the SAT are not required, but in some situations they are able to enhance the special talents of a particular applicant. Each applicant will be sent a supplemental form to write an essay and return directly to the College. Freshman applicants are also encouraged to have an on-campus interview to further their understanding of the College and its programs.

Since the College cannot offer admission to all freshman applicants, it reserves the right to offer a delayed admission to those not immediately acceptable. Therefore, some applicants will be offered a guarantee of admissions for either their sophomore or junior year of college under the assumption they will satisfactorily complete their freshman and/or sophomore year(s) at another institution.

ADVANCED EARLY ADMISSIONS

The College also recognizes that some students have made arrangements to spend some part of their first two years of college at other institutions and will transfer to ESF in either their sophomore or junior year. In order to facilitate this process and to reduce any difficulty associated with transferring, ESF has established an *Advanced Early Admissions* option. Under this AEA enrollment option, students will be guaranteed admission to ESF for either their sophomore or junior year and benefit from long-term academic advising. Students are guided through their early years of college by selecting the correct courses to facilitate transferring to ESF. AEA accepted students also receive special mailings and invitations to participate in activities on the ESF campus.

High school seniors who wish to enroll in Landscape Architecture, Wood Products Engineering or Environmental Studies should apply to ESF under the AEA option and expect to enroll at ESF in their junior year of college.

TRANSFER ADMISSIONS

The largest number of students who enroll at ESF *transfer* to the College after spending one or two years at another institution. Unless guaranteed admission to ESF under the standards of the AEA option, the admissibility of transfer students is based heavily on the distribution of an applicant's previous coursework (for most programs a significant emphasis is placed on mathematics and science), and the students' overall academic performance and interest in the programs offered by the College. Consideration is given to both the quality and appropriateness of the students' prior academic experience. The minimum grade point average for consideration is 2.000 (4.000=A).

DEFERRED ADMISSIONS

Accepted applicants wishing to defer their ESF enrollment for one or two semesters are required to make this request in writing directly to the Office of Undergraduate Admissions. Requests will be approved in writing. A $100 nonrefundable advance deposit fee will be required, and will be applied towards future tuition obligation.

FOREST TECHNOLOGY ADMISSIONS

Since the New York State Ranger School (NYSRS) does not enroll freshmen, candidates can only apply to Forest Technology either under the Advanced Early Admissions option or as a transfer student. High school students desiring to attend this program in 1992 should apply during their senior year to receive a guarantee of this entry date. For further information on the NYSRS, see page 69, or contact the ESF Office of Undergraduate Admissions.

ADMISSIONS APPLICATION DEADLINE

FRESHMAN—Fall Enrollment—March 1
TRANSFER—Fall Enrollment—May 1
Spring Enrollment—December 1

VISITATION SCHEDULE

The College welcomes visitors to its campus. Prospective students who wish to meet with a member of the admissions staff or have a campus tour are requested to call and make an appointment. Appointments are made Monday through Friday from 9 A.M. to 3 P.M. Tours for prospective students are provided by the Admissions office and given by ESF students. Tours are available most weekdays at 10 A.M. and 2 P.M.

PRE-ESF COOPERATIVE TRANSFER PROGRAMS

The College, working in cooperation with other collegiate institutions, both in and out of New York State, has developed 55 pre-environmental science and forestry programs. The development of these programs illustrates that high school students can look forward to a wide selection of colleges in which they can obtain the necessary lower division courses and appropriate advisement to transfer to ESF.

These colleges represent the total spectrum of higher education (private, public, 4-year, 2-year) and are located in New York, Connecticut, Massachusetts, New Jersey, Pennsylvania, Rhode Island, and Maryland. Students who

attend these colleges will find a smooth articulation has been established and once they transfer to ESF will share a common academic background with other transfer students.

Currently, the list of cooperative colleges includes:

New York State Colleges

Adirondack Community College, Glens Falls
Broome Community College, Binghamton
Canisius College, Buffalo
Cayuga County Community College, Auburn
Columbia-Greene Community College, Hudson
Community College of Finger Lakes, Canandaigua
Corning Community College, Corning
Dutchess Community College, Poughkeepsie
Erie Community College, Buffalo
Herbert H. Lehman College, Bronx
Herkimer Community College, Herkimer
Hudson Valley Community College, Troy
Jamestown Community College, Jamestown
Jefferson Community College, Watertown
Kingsborough Community College, Brooklyn
LeMoyne College, Syracuse
Mohawk Valley Community College, Utica
Monroe Community College, Rochester
Nassau Community College, Garden City
Niagara County Community College, Sanborn
North Country Community College, Saranac Lake
Onondaga Community College, Syracuse
Orange Community College, Middletown
Rockland Community College, Suffern
St. John Fisher College, Rochester
Siena College, Loudonville
Suffolk County Community College, Selden
Sullivan County Community College, Loch Sheldrake
SUNY College of Technology at Alfred
SUNY College of Technology at Canton
SUNY College of Agriculture and Technology at Cobleskill
SUNY College at Cortland
SUNY College of Technology at Delhi
SUNY College at Geneseo
SUNY College of Agriculture and Technology at Morrisville
SUNY College at New Paltz
SUNY College at Oneonta
SUNY College at Oswego
Syracuse University
Tompkins Cortland Community College, Dryden
Ulster County Community College, Stone Ridge
Westchester Community College, Valhalla

Out-of-State Colleges

Allegany Community College, Cumberland, MD
Berkshire Community College, Pittsfield, MA
Camden County College, Blackwood, NJ
Garrett Community College, McHenry, MD
Holyoke Community College, Holyoke, MA
Housatonic Community College, Bridgeport, CT
Keystone Junior College, LaPlume, PA
Middlesex Community College, Edison, NJ
Montgomery Community College, Rockville, MD
Northampton Community College, Bethlehem, PA
Ocean County College, Toms River, NJ
Roger Williams College, Bristol, RI
Union College, Cranford, NJ

Transfer Credit

Courses transferred for credit must be appropriate to the student's curriculum choice. Credit will be awarded for *appropriate* courses completed with a passing grade of "D" or better.

Furthermore, courses to be transferred as required courses in a curriculum must be acceptable in content. Course credit hours are transferred, but grades and grade points are not.

All transfer credit will be tentative until all official, final transcripts are received. It is the student's responsibility to see that this is done.

International Students

ESF accepts international students on the undergraduate level, if they satisfy all regular admission requirements. International students applying for admission must satisfy all of the course prerequisites for their intended major. In addition, they must:

1. Demonstrate proficiency in the English language through acceptable performance on the Test of English as a Foreign Language (TOEFL) *(usually 550 or better)* or the College Entrance Board (CEEB) Achievement Test in English *(usually 550 or better) or by completing the first two years of college at an institution where the courses were taught in English;* and

2. Produce evidence of their ability to meet all their financial obligations.

Undergraduate international students must file official State University of New York foreign student admission forms. No fee is required for processing these forms. After acceptance, health and accident insurance must be obtained before the student will be allowed to register at ESF.

International students who are currently enrolled at an American college may apply for transfer to ESF. *In addition to the entrance requirements for other international students, they must also obtain permission* from the U.S. Immigration and Naturalization Service district office having jurisdiction over the college in which the student is currently enrolled.

COLLEGE CREDIT BY EXAMINATION

For freshman applicants, the College will consider for credit any Advanced Placement (AP) examination with a score of 5, 4 or 3; or CLEP examinations with a score of 47. For transfer students, ESF will generally accept the same credit as was granted by the transferring college for AP and CLEP. Further information is available from the Office of Undergraduate Admissions.

EDUCATIONAL OPPORTUNITY PROGRAM

The basic goal of the Educational Opportunity Program at the College is to provide qualified students with a college education—the opportunity for personal growth and professional development. Upon completion of the program, graduates will be provided access to jobs in professional fields. The program is not designed for students who need only financial assistance. It serves students who ordinarily would not be able to attend college because of a lack of financial resources and insufficient academic preparation. To qualify, students must be New York State residents and demonstrate the potential to successfully complete the courses of study at the College.

Counseling, financial assistance and tutoring are provided on an individual basis. In order for students to be on the EOP program at ESF, they must have been an EOP student at their prior institution. Therefore, students who are applying to ESF as high school seniors (via Advanced Early Admission), should also apply for EOP at the lower division college.

Further information regarding the Educational Opportunity Program may be obtained by contacting the EOP Director.

HEALTH EXAMINATION BOARD

Each new student is required to submit a medical history and physical examination report on a form that will be sent after the initial acceptance notice.

GRADUATE ADMISSION

Admission to graduate studies is conditional upon review and acceptance of the applicant's credentials by appropriate faculty members and upon the recommendation of the appropriate Faculty Chair to the Dean of Instruction and Graduate Studies. Required for admission are at minimum a bachelor's degree from a recognized institution, and generally an academic record showing at least a B average for junior and senior years of the baccalaureate program or for the master's program. Also required are Graduate Record Examination scores and for some degree programs, advanced test scores (see below); supporting letters of recommendation; and a statement of educational and professional goals. A non-refundable $35 application fee is required. *Graduate Record Examinations scores may be waived by a Faculty on an individual basis.*

INTERNATIONAL STUDENTS

Citizens of other countries with special educational objectives are accepted for graduate study in all programs. They must show satisfactory evidence that they have completed studies in their major field equivalent to those at a recognized American institution with a scholastic record equivalent to a B average in their junior and senior years. They must submit Graduate Record Examination scores as explained in the section on **Procedure**. Also applicants whose native language is other than English must achieve at least a 5.50 on the Test of English as a Foreign Language (TOEFL). This requirement may be waived if the student has received a degree from an American institution. This examination is offered several times each year in major cities of the world.

For information on registration and scheduling, write to the Educational Testing Service, Princeton, New Jersey 08540, U.S.A. In submitting test scores, request that they be sent to the Office of Academic Programs.

ADVANCED TESTS

Subject matter (advanced) test scores are required by the following programs:

Graduate Programs	*Advanced Test*
Chemistry	Chemistry
Environmental and Forest Biology	Biology

PROCEDURE

Applicants are generally required to submit Graduate Record Examination aptitude scores. This examination is offered several times each year in major cities of the world. For information on registration and scheduling write to the Educational Testing Service, Princeton, New Jersey 08540. Test scores should be sent to the Office of Academic Programs (Institutional number R2530).

The College provides a special application form for graduate work. Requests for information and applications should be addressed to the Office of Instruction and Graduate Studies.

EXPENSES

APPLICATION FEE

When a student applies for admission to an undergraduate program at any of the State University of New York units, a nonrefundable application fee is required. More information about fee and guidelines for exemptions is provided in the "Application Guidebook" for the State University of New York. There is a $35 application fee for those applying for graduate study.

ADVANCED PAYMENT DEPOSIT

All admitted undergraduate students pay a deposit of up to $100 which is credited to the students' first semester tuition. The students will be notified at the time of acceptance of the amount and when the deposit is due, as well as the refund guidelines for this deposit. There is no advance payment deposit required for those accepted for graduate study.

TUITION AND COLLEGE FEE (Effective Fall 1990)

The Tuition and College Fee structure of the College is set by the Board of Trustees, State University of New York, and covers usage of library, infirmary, physical education facilities, ROTC, special testing, charges for expandable supplies, and other College services.

The current tuition schedule per semester is listed below.

RESIDENCY

'Residence' for purposes of this (tuition payment) question refers to the principal or permanent home to which the student returns. If the principal or permanent home has not been located in New York State for a twelve-month period prior to the date of registration for the academic term for which this application is made, the student will be presumed to be an Out-of-State resident for purposes of tuition.

STUDENT ACTIVITY FEES

In addition to tuition, the student body has voted to assess each full-time undergraduate student $60 per year to cover the cost of student activities. Full-time, nonmatriculated students are charged a fee of $30 per semester, and part-time matriculated students $1.50 per credit hour. Part-time matriculated graduate students are charged $7.00 for student activity fee. Full-time graduate students likewise have a mandatory activity fee of $28. ESF students also pay an activity fee to Syracuse University to cover SU-sponsored activities and services available to ESF students, not duplicated by College organizations. These fees are $26.75 for full-time undergraduate and $15 for full-time graduate students. Part-time matriculated students are charged $17.50 per year payable at fall registration; part-time matriculated graduate students are charged $10 per year.

Student Support Services Fee

Effective in the Spring, 1991 semester, all full-time students will pay $87.50 per semester to partially offset the cost of academic and other support services provided by Syracuse University. Part-time students will be charged $7.50 per credit hour.

COMMENCEMENT FEE

A commencement fee of $14 is required at the beginning of the semester in which the degree is expected. Additional costs are incurred by graduate students for the binding, abstracting, and microfilming of theses.

INTERNATIONAL STUDENT MANDATORY HEALTH INSURANCE

All international students attending SUNY must participate in the SUNY International Health Insurance Program. The cost is $501.00 per year. Dependent coverage is available from the carrier.

Tuition Type	NYS Resident Students	Out-of-State Students
Undergraduate Matriculated		
Full-Time	$ 675.00	$2,350.00
Part-Time	$ 45.00/credit hour	$ 157.00/credit hour
Graduate Matriculated		
Full-Time	$1,075.00	$2,732.50
Part-Time	$ 90.00/credit hour	$ 230.00/credit hour
Continuing Education—Non-Degree		
Students who do not hold a Baccalaureate Degree		
Course Nos. 0-599	$ 45.00/credit hour	$ 157.00/credit hour
Course Nos. 600-999	$ 90.00/credit hour	$ 230.00/credit hour
Students who hold a Baccalaureate Degree		
Course Nos. 0-499	$ 45.00/credit hour	$ 157.00/credit hour
Course Nos. 500-999	$ 90.00/credit hour	$ 230.00/credit hour
Maximum Total Tuition for 12 credit hours or more	$1,075.00	$2,732.50

The **College Fee** is an additional $12.50 per semester for full-time students and $.85 per credit hour for part-time students. Full-time student status for tuition purposes are those students taking 12 credit hours or more.

TERMS OF PAYMENT

The College sends each student expected to register for the upcoming semester, at their permanent address, a detailed invoice indicating amounts due six weeks prior to the start of the semester. This invoice includes *only* ESF charges. See below Housing and Board Costs at Syracuse University. Payment is encouraged prior to the one-day-scheduled registration period and *MUST* be made prior to the first day of classes. Detailed instructions are included with the invoice. The College participates in the AMS payment plan.

HOUSING AND BOARD COSTS

ESF does not operate student residences or dining halls. These facilities are offered by Syracuse University. Specific information about available housing and board plans is available from the Office of Residence and Dining Services, Syracuse University, Syracuse, New York 13210.

In general, housing costs at SU range from $1,020 to $1,765 per semester, reflecting the diversity of available accommodations for graduate or undergraduate, single or married students. Most dormitory rooms accommodate two students and are furnished with beds, mattresses, desks, chairs, study lamps and dressers. A commercial linen service is available to those who order it. Separate dormitories are maintained for graduate students.

Furnished and unfurnished apartments are also available for both single and married students. These are located in a housing complex approximately two miles from the main campus, and are regularly serviced by a free shuttle-bus.

A variety of meal plan options are available to all students, whether or not they reside in University dormitories. Costs range from $500 to $1,395 per semester.

In addition, a wide variety of living arrangements in private homes and apartment complexes is available in the Syracuse metropolitan area.

Payment for housing and meals is made directly to Syracuse University.

OTHER COSTS

Students majoring in resource management attend a seven-week Summer Session in Field Forestry at the Warrensburg Campus between the sophomore and junior years. Forest biology majors have the option of attending this session or the Summer Session in Environmental Biology at the Cranberry Lake Biological Station at the end of the junior year. Cost for the Warrensburg session is approximately $1,050 and $825 for the four-week program at Cranberry Lake, plus travel and personal expenses.

An extended field trip of up to two weeks at the end of the junior year costs approximately $250 for Wood Products Engineering students.

Field trips for Landscape Architecture students range between $125 and $150. In addition, students enrolled in the five-year Landscape Architecture program are required to spend one semester off campus. **This is a self-described and student-budgeted program. Costs do not necessarily exceed those of a semester on campus, but additional costs are often incurred depending upon the location chosen. These additional costs are the responsibility of the student and are not covered by financial aid.**

The cost of books and supplies is approximately $300 a year. Additional costs for personal expenses, recreation, clothes and travel depend on the individual, and they may range from $600 to $800 a year.

REFUNDS

The following policies apply to tuition liability and refunds for students canceling their registration.

A student who is given permission to cancel registration is liable for payment of tuition in accordance with the following schedule:

Liability During Semester	
1st week:	0%
2nd week:	30%
3rd week:	50%
4th week:	70%
5th week:	100%

Application for refund must be made within one year after the end of term for which the tuition was paid to State University. The first day that classes are offered, as scheduled by the campus, shall be considered the first day of the semester, and the first week of classes for purposes of refunds shall be deemed to have ended when seven calendar days, including the first day of scheduled classes, has elapsed.

There is no tuition or fee liability established for a student who withdraws to enter military service prior to the end of an academic term for those courses in which the student does not receive academic credit.

A student who is dismissed for academic or disciplinary reasons prior to the end of an academic term is liable for all tuition and fees due for that term.

A student who cancels registration at a unit of the State University and within the same term registers at another unit of the State University is entitled to full credit for tuition and fees paid for that term.

Notwithstanding any other provisions for refund, when a student has withdrawn through circumstances beyond the student's control, under conditions in which the denial of refund would cause undue hardship, the Chief Administrative Officer of the unit may, at his discretion, determine that no liability for tuition has been incurred by the student, provided the student has not completed more than one half of the term and has not received or will not receive academic credit for the term. Such action, including the reason for withdrawal, must be in writing.

FINANCIAL ASSISTANCE

The College of Environmental Science and Forestry offers six basic forms of student financial assistance: scholarships or grants, part-time employment, long-term loans, assistantships for graduate students, a deferred tuition payment plan and sources of nonneed loans to parents. Federal and state financial aid programs are for U.S. citizens, permanent residents, or holders of I-151 cards. These programs are coordinated to supplement parental support, summer work, savings, and assistance from other sources. The sources of funds for financial assistance programs, the guidelines for determining the recipients, the procedures for applying, and the method of disbursement of funds vary from one program to another. This information is presented in detail in *Financial Assistance at ESF*, a separate publication which is mailed to all applicants, and is available to the public by contacting the Office of Financial Aid.

Financial aid is awarded primarily on the basis of financial need. There are some scholarships which are based on other criteria (academic achievement or minority status.) In order for students to receive aid, they must be making satisfactory academic progress towards their degrees.

Financial aid advisors are aware of the many problems of financing higher education and meeting day-to-day living expenses for both undergraduate and graduate students, and are available to discuss individual student problems. **All students are encouraged to apply for financial aid.**

HOW TO APPLY

Each year students interested in receiving financial assistance, *except for graduate assistantships only*, must complete the application process. (Graduate students who wish to be considered for a graduate assistantship only refer to page 26, and follow those instructions.) *Two forms are necessary to apply:*

1. The student must complete a College Aid Application and Financial Aid Transcript and return it to the Office of Financial Aid by the following dates: February 15 for early consideration; March 15 for regular consideration. The application is included in the publication, *Financial Assistance at ESF. Applications will be accepted after March 15;* it should be noted, however, that available funds may already be committed to other students. Applicants need not wait for notification of acceptance to the College before applying for financial aid.

2. The student must also complete and submit after January 1 the Family Financial Statement (FFS) to the American College Testing Co., Iowa City, Iowa. The FFS is available in the College's Office of Financial Aid, high school guidance offices, and college financial aid offices.

Students are invited to discuss with the professionals in the Financial Aid Office any problems in financing their education.

This application information is based on current requirements. Financial aid systems and forms are undergoing constant changes. Applicants are urged to contact the Office of Financial Aid for the latest information and requirements.

SELECTION OF RECIPIENTS

In making award decisions, consideration is given primarily to comparative financial need; however, scholastic standing, character, and potential contribution to the College community are also factors in making certain awards.

VERIFICATION OF INFORMATION

All students who request financial assistance will be required to submit information on their family's financial situation prior to aid disbursement. The College will request copies of parents' and students' federal tax forms, along with other statements which verify other sources of income, family size, number in college, etc.

Failure to comply with a request to verify information will result in a cancellation of any aid offered and the potential of legal action by the U.S. Department of Education.

Retention of Awards—State (TAP, STAP)

All students who are awarded financial assistance will be required to maintain satisfactory academic progress each semester in order to keep their awards. Satisfactory academic progress for all programs, *except New York State* (TAP, Regents, etc.), is defined on page 22 of this catalog.

Recipients of a New York State award must adhere to the following State requirements (See chart, p. 22):

(1) Academic Progress—A student will need to meet the stated minimums on the following charts to be eligible for the next semester award.

(2) Program Pursuit—Students must complete a minimum number of semester hours each semester. *A.A.S. degree students* are required to complete 75 percent of the full-time load. Full time is defined as 12 credit hours. Therefore, $.75 \times 12 = 9$. Nine credit hours must be completed each semester.

Bachelor degree students must complete 100 percent of full-time load each term. Full time is 12 credit hours. Therefore, students must register for and complete at least a minimum of 12 credit hours each term.

Graduate degree students with an assistantship are considered full time if they are registered for at least nine credits each semester and making satisfactory progress toward a graduate degree. If a graduate student with an assistantship has met all requirements during a semester and does not need nine credits, that student may register for fewer credits, but at least

one, with the permission of the major professor. All other students are full time with 12 credits.

Waivers for New York Awards

Should a student fall below the requirement, he/she may apply for a waiver. Students are allowed *only one* waiver during undergraduate work and *only one* during graduate work. The issuance of the waiver will be granted only after the student and the institutional waiver designee have mutually concurred that such issuance is in the best interest of the student. Request for a waiver is made through the Director of Financial Aid.

Standard of Satisfactory Academic Progress for Purpose of Determining Eligibility for State Student Aid: All Campuses—State University of New York

Calendar: Semester — Programs: Associate Degrees and Certificate Programs

Before being certified for this payment,	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
a student must have accrued at least this many credits,	0	3	9	18	30	45	60	75
with at least this grade point average.	.000	.500	.750	1.300	1.500	1.700	2.000	2.000

Noncredit remedial instruction can be counted toward a full-time academic load as set forth in 145-2.1 of the Commissioner's Regulations. The number of credits in this chart refers to work completed toward the degree.

Calendar: Semester — Program: Baccalaureate Degree

Before being certified for this payment,	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Tenth
a student must have accrued at least this many credits,	0	3	9	18	30	45	60	75	90	105
with at least this grade point average	.000	.500	.750	1.200	1.400	1.500	1.600	1.700	1.800	1.900

Noncredit remedial instruction can be counted toward a full-time academic load as set forth in 145-2.1 of the Commissioner's Regulations. The number of credits in this chart refers to work completed toward the degree.

Calendar: Semester — Programs: All Graduate Level Programs except Professional

Before being certified for this payment,	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
a student must have accrued at least this many credits,	0	6	12	21	30	45	60	75
with at least this grade point average.	.000	2.000	2.500	2.750	3.000	3.000	3.000	3.000

Retention of Awards—Title IV (See chart, p. 23)

In order for students to be eligible for Title IV Federal Student Assistance (Pell Grants, Supplemental Educational Opportunity Grant, Perkins Student Loan, Guaranteed Student Loan, College Work-Study Program, PLUS), both undergraduate and graduate students must meet specified criteria.

The criteria that students must meet to be eligible for Title IV student aid are the same criteria *all* ESF students must adhere to with regards to institutional academic policies and specifically academic progress towards their degree. The evaluation criteria are:

(1) Appropriate grade point average for satisfactory academic progress.
(2) Successfully accumulate credits towards their degree.
(3) Obtain their degree within the prescribed degree time limit. Time limits vary for individual programs and are illustrated on the adjacent charts.

Standard of Satisfactory Academic Progress for Purpose of Determining Eligibility for Federal Aid

Calendar: Academic Year — Program: Associate Degree

Academic years completed at ESF	2	3
A student must have successfully completed this number of credit hours	45	76
with at least this cumulative grade point average	2.000	2.000

Calendar: Academic Year — Program: Baccalaureate Degree

Academic years completed at ESF	1	2	3	4	5	6
A student must have successfully completed this number of credit hours	10	40	70	100	130	160
with at least this cumulative grade point average	2.000	2.000	2.000	2.000	2.000	2.000

Calendar: Academic Year — Program: All Master Level Programs

Academic year completed at ESF	1	2	3
A student must have successfully completed this number of credit hours	15	27	42
with at least this cumulative grade point average	3.000	3.000	3.000

Calendar: Academic Year — Program: All Ph.D. Level Programs

Academic year completed at ESF	1	2	3	4	5	6	7
A student must have successfully completed this number of credit hours	15	27	42	54	66	75	90
with at least this cumulative grade point average	3.000	3.000	3.000	3.000	3.000	3.000	3.000

Appeal/Probation/Reinstatement

Students who fall beneath the minimum standards may appeal through the College Subcommittee on Academic Standards to retain their eligibility for receipt of Title IV Federal Student Assistance. (See Academic Dismissal p. 28.)

These appeals should be evaluated for mitigating circumstances such as injury, illness, etc., and the reasonableness of the student's ability to move back up to the appropriate standard. If the College Subcommittee on Academic Standards places a student on "academic probation," the student is still eligible for Title IV aid as defined by the statement of "Good Academic Standing" (p. 26).

Notification

Students will be notified via certified mail of their individual circumstances if they fall below the standards, appeal loss of eligibility, or reinstatement of eligibility.

SCHOLARSHIP AND GRANT PROGRAMS

Supplemental Educational Opportunity Grants (SEOG)

The College is the recipient of funds authorized under Title IV-A of the Higher Education Act of 1965, as amended. These funds enable the College to award grants to undergraduate students who have financial need. Grants range from $100 to $4,000 per year.

ESF Educational Opportunity Program (EOP)

Students accepted into the College's Educational Opportunity Program may receive, in addition to other financial assistance, a special award to pay for education-related costs. Students must come from a socio-economically and academically disadvantaged background to be eligible.

Prospective Educational Opportunity Program students must apply for financial aid when submitting their admissions applications.

Pell Grants (Formerly Basic Educational Opportunity Grants)

The Pell (BEOG) Program was authorized in the Educational Amendments of 1972. Grants are available to eligible full-time, half-time, and less than half-time undergraduate students. The amount of the award can vary from $250 to $2,300.

Applications are available from high school guidance offices or any college office of financial aid. Students should submit the Student Aid Report (SAR) to the Office of Financial Aid as soon as it is received from the processor.

Regents Programs

Additional information and applications for the following programs are available from the College or:

New York Higher Education Services Corporation
Tower Building
Empire State Plaza
Albany, New York 12255

REGENTS COLLEGE SCHOLARSHIPS

High school students who are New York State residents may qualify for a $250 annual scholarship by taking a competitive exam during their senior year.

TUITION ASSISTANCE PROGRAM

These awards are available to New York State residents who are enrolled in full-time degree programs. Based on income, awards range from $350 to full tuition.

LIBERTY SCHOLARSHIP

The Liberty Scholarship award is for nontuition college expenses such as room and board, books, supplies, and transportation. The award is based on:

- The adjusted gross income of the student's family.
- Nontuition college costs at SUNY.
- Other student financial aid the student receives.

The awards are intended primarily for low-income students. As a family's income rises, the student's Liberty Scholarship award will be reduced.

REGENTS GRANTS OR CHILDREN OF DECEASED OR DISABLED VETERANS

These grants are awarded to children of parents who served during specific periods of war or national emergency and who died as a result of such service, or suffered a disability of at least 50 percent. The award entitles a New York State resident to $450 per year.

Vocational Rehabilitation Grants

Financial assistance and program counseling are provided by New York State for students with disabling handicaps. Information is available from any Office of Vocational Rehabilitation.

Veterans' Benefits

The Veterans' Readjustment Benefits Act of 1966 as amended enables veterans and children of deceased or disabled veterans to obtain financial aid for their college education.

Additional information and counseling are available from the Veterans' Affairs Counselor, Mr. Robert North, Office of the Registrar. Local veterans' administrations offices, or the State Regional Office, 111 West Huron Street, Buffalo, New York 14202, can provide information and application forms.

Assistance for Native American Students

Native American students with financial need may be eligible for scholarship and grant assistance through programs sponsored by the federal Bureau of Indian Affairs and the New York State Education Department. For more information about the programs, students should contact the Bureau of Indian Affairs, 1951 Constitution Avenue NW, Washington, D.C., or the Native American Education Unit, State Education Department, Education Building Annex, Albany, New York 12234.

Private Fellowships, Scholarships, and Grants

The College administers a number of programs which have been established by private individuals, companies, organizations and foundations. These scholarships and grant programs have varying eligibility requirements and are awarded to students according to their respective guidelines which are described in more detail in *Financial Assistance at ESF.* The following is a list of the programs: Alumni Memorial Awards; Alumni Educational Grants; John Berglund Memorial Scholarship; Nelson Courtlandt Brown Scholarship Fund; Morris Hirsch Scholarship; John J. View Scholarship; John Clark Scholarship; SUNY Minority Student Scholarship; Ray Rizzo Scholarship; Phillip Zipf Scholarship; Ranger School Alumni Scholarship; Henry H. Buckley Student Aid Award; Simeon H. Bornt III Scholarship Award; Eugene C. Reichard Scholarship Award; Walter Tarbox Memorial Scholarship; Warren Bennett Memorial Award; Wilford A. Dence Memorial Award; Meyer Environmental Chemistry Scholarship Award; Meyer Wood-Plastic Scholarship Award; Edward Aalbue Memorial Scholarship; Lt. Gary Scott Memorial Scholarship; Gerald H. Williams Scholarship; Portia Farrell Morgan Scholarship; Phyllis Roskin Memorial Award; Wildfowlers Association of Central New York Scholarship; Onondaga Angler's Association Scholarship; Maurice Alexander Wetland Research Award; and Student Association Grants.

Syracuse Pulp and Paper Foundation, Inc. Scholarships

Scholarships from this foundation are awarded to United States citizens who are students in paper science and engineering and have a 2.500 grade point average (out of a 4.000). The scholarship may amount to the recipient's annual tuition charge. Incoming transfer students entering the program may ascertain the award amounts currently being offered and request a Pulp and Paper Scholarship application from the Office of Financial Aid. It is necessary to reapply each year for the scholarship.

State University Supplemental Tuition Assistance

A limited number of small grant awards are determined annually by the College for students with financial need.

EMPLOYMENT OPPORTUNITIES

College Work-Study Program (CW-SP)

The College participates in the Federal College Work-Study Program, which provides part-time jobs during the academic year and full-time positions during the summer to students who need financial assistance to attend the College. Wages for these positions begin at above the minimum wage and increase as duties and responsibilities increase. Current wages paid are: summer $6.00/hour, academic year $4.50/hour.

Job Locator Service

The College coordinates and maintains an active program of part-time and summer employment opportunities. Interested students should contact the Student Employment Coordinator in the Office of Financial Aid for additional information. The program is open to all ESF students seeking employment.

LOANS

Perkins Student Loans (formerly N.D.S.L.)

These loans are available to students with financial need who are enrolled at least half-time. Amounts which can be borrowed are $4,500 for 2 years and $9,000 for 4 years with a maximum of $18,000, including graduate study. Repayment and 5 percent interest begin 9 months after leaving college. Deferment and cancellation benefits are available for certain situations. The average loan amount per student in 1989-90 was $1,674.

Guaranteed Student Loans

This program is administered by the New York Higher Education Services Corporation (NYHESC) for New York State residents. These loans are available from a bank or other lending agent to students who are registered at least half-time. Undergraduates can borrow an aggregate of $17,250 for their undergraduate studies, and a graduate student can borrow an aggregate of $54,750. Repayment and 8 percent interest begin 6 months after leaving college (an additional 1 percent interest is paid at the time the loan is received). Applications are available at local banks. The average GSL amount per student in 1989-90 was $3,231.

Parent's Loan (PLUS)

Parents of students may borrow up to $4,000 annually and $20,000 overall, at an interest rate of 12 percent. Loan repayment begins 60 days after receipt of the loan. Total loans to parents and students cannot exceed total cost of education. Applications are available at local lending institutions.

Supplemental Loan to Students (SLS)

For graduate, professional, or independent undergraduates who wish to borrow above their G.S.L. limits.

They may borrow up to $4,000 per year. Aggregate amount is $20,000.

Emergency Loans

The College is able to provide registered students interest-free, short-term loans (30 days). These loans are available because of the interest and support of the following donors: Alumni Association Short-term Loan Fund; David B. Schorer Memorial Fund; and Edward Vail Emergency Fund.

Students should contact the Office of Financial Aid when need arises for a short-term loan.

GRADUATE ASSISTANTSHIPS

Assistantships are awarded to students of demonstrated scholarship and whose education and experience enable them to assist in laboratory instruction and research. The amounts of the assistantships range from $6,800 for an academic year to as high as $18,000 for a calendar year. In addition, tuition may be waived. Students who hold an assistantship must be enrolled for full-time study.

Beginning graduate students may apply for assistantships on their application for admission, and continuing graduate students should consult with their major professors.

ACADEMIC POLICIES

EDUCATION LAW

Students unable, because of religious beliefs, to attend classes on certain days are guided by Section 224a of the New York State Education Law which is as follows:

> "1. No person shall be expelled from or be refused admission as a student to an institution of higher education for the reason that he is unable, because of his religious beliefs, to attend classes or to participate in any examination, study or work requirements on a particular day or days.
>
> "2. Any student in an institution of higher education who is unable, because of his religious beliefs, to attend classes on a particular day or days shall, because of such absence on the particular day or days, be excused from any examination or any study or work requirements.
>
> "3. It shall be the responsibility of the faculty and of the administrative officials of each institution of higher education to make available to each student who is absent from school, because of his religious beliefs, an equivalent opportunity to make up any examination, study or work requirements which he may have missed because of such absence on any particular day or days. No fees of any kind shall be charged by the institution for making available to the said student such equivalent opportunity.
>
> "4. If classes, examinations, study or work requirements are held on Friday after four o'clock post meridian or on Saturday, similar or makeup classes, examinations, study or work requirements shall be made available on other days, where it is possible and practicable to do so. No special fees shall be charged to the student for these classes, examinations, study or work requirements held on other days.
>
> "5. In effectuating the provisions of this section, it shall be the duty of the faculty and of the administrative officials of each institution of higher education to exercise the fullest measure of good faith. No adverse or prejudicial effects shall result to any student because of his availing himself of the provisions of this section.
>
> "6. Any student, who is aggrieved by the alleged failure of any faculty or administrative officials to comply in good faith with the provisions of this section, shall be entitled to maintain an action or proceeding in the supreme court of the county in which such institution of higher education is located for the enforcement of his rights under this section."

Statement of "Good Academic Standing"

The term "in good academic standing" means that a student is eligible or has been allowed to register for and undertake academic coursework at the College for the semester in question. In some instances the College may define a student as being "on academic probation." The mechanism of academic probation, including any accompanying constraints upon a student's activities, is intended merely as an educational device designed to encourage greater effort on the part of students who are having difficulty in meeting certain academic standards. Placement on academic probation may precede denial of the right to register for academic coursework if certain conditions are not met, but a student on academic probation is considered to be in good academic standing. Any question concerning whether or not an individual student is in good academic standing will be determined by the Dean of Instruction and Graduate Study.

UNDERGRADUATE POLICIES

General Requirements

A student seeking a degree must be in matriculated status. All degree requirements *must* be completed through a combination of formally accepted transfer credits and/or courses taken at ESF and Syracuse University. While a student is matriculated at ESF, all courses taken at ESF and Syracuse University to meet degree requirements must be graded on a scale of "A - F," and the grades will be computed in the grade point average.

Credit Hour Load

To be classified as full-time, a student must register for at least 12 credit hours during a semester. A student may not register for more than 18 credits during a semester unless permission from the student's advisor is obtained.

Attendance

Students are expected to adhere to the attendance policy stated by each course instructor. Instructors may make attendance part of the course requirement.

Course Numbering System

Courses at ESF are numbered according to the following system:

100–499—Undergraduate courses for which no graduate credit may be given.

500–599—Graduate courses designed expressly for areas of specialization in post-baccalaureate programs or in the professional program leading to the Bachelor of Landscape Architecture. Qualified undergraduate students may enroll by permission of the instructor.

600–699—Graduate courses designed expressly for advanced levels of specialization. Undergraduate students with a cumulative grade point average of 3.000 or better may enroll in these courses with an approved petition.

700–999—Advanced graduate level courses for which no undergraduate students may register.

Shared resources courses, designated as 400/500 or 400/600, are designed when the topic coverage of both courses is the same. Separate course syllabuses are developed expressly differentiating the requirements and evaluative criteria between the undergraduate course and the graduate course.

Physical Education and R.O.T.C.

Physical Education and R.O.T.C. course credits may be used to satisfy elective requirements with the permission of the student's academic advisor.

Audits

Students may informally audit ESF courses with the permission of the course instructor. No record will be maintained of the informal audit nor will any grade be assigned. No fee is required for informal audits.

Students may formally audit courses with the permission of their academic advisor and the course instructor. They may not be used to satisfy any graduation requirements. Formally audited courses will appear on the students' transcripts and will be graded either "SAU" (satisfactory audit) or "UAU" (unsatisfactory audit). The grade will be assigned based on the criteria for audit established by the course instructor. Registration guidelines for audited courses are the same as for courses taken for credit.

Dropping or Adding Courses

Students may add courses with the approval of both their academic advisor and the course instructor and may drop courses with their advisor's approval and notification to the course instructor via an appropriate drop/add form until the last day for program adjustments as listed in the ESF calendar. Courses dropped during this time will not appear on the student's transcript. Courses that begin after the published add date may be added prior to the start of the course. Courses that last for less than one semester may be dropped no later than half way through the course. In either case, the student must submit a completed add-drop form.

Repeating Courses

Students may repeat any course previously taken either to earn a higher grade or because of a previous failure. However, the credit hours for the course repeated may be counted only once toward meeting graduation requirements. Credit hours carried and grade points earned will be included in the semester and cumulative grade point averages each time the course is completed.

Withdrawal from ESF

Students who withdraw on or before the "drop date" for a semester will have their records marked "Withdrew on (date)." Courses will appear for that semester with the grade of "W."

Students who withdraw after the "drop date" for a semester, but on or before the last class day before the final examination period, will have either "WP" (withdraw passing) or "WF" (withdraw failing) listed after each uncompleted course. Students who do not withdraw on or before the last class day will have a grade of "A - F," "I," or "I/F" assigned by the instructor for each registered course.

Students who withdraw from ESF and in the future wish to return must apply for readmission. Prior to withdrawal from ESF, students must schedule an interview in the Office of Student Affairs and Educational Services.

Curriculum Requirements

The development and administration of course offerings, prerequisites, sequencing, and program requirements are primarily the responsibility of each program Faculty with the approval of the ESF Faculty.

Students must satisfy the requirements for graduation presented in the catalog in effect as of the date they first matriculate at ESF. Students may graduate under the requirements stated in any catalog issued subsequent to the one in effect the date they matriculate, but they may not use a prior catalog.

Students who change majors are required to submit a completed change of curriculum form approved by representatives of both programs and must complete all the requirements of their new major.

Evaluation

For each course completed, one of the following grades will be awarded:

Grade	Definition	Grade Points
A	Excellent	4.000
A−		3.700
B+		3.300
B	Good	3.000
B−		2.700
C+		2.300
C	Passing	2.000
C−		1.700
D	Minimum Passing	1.000
F	Failure	0.000
I/F	Unresolved Incomplete	0.000

In order to receive a bachelor's degree, a student must complete all courses taken as a matriculated student at ESF with a cumulative grade point average of at least 2.000.

Under conditions defined elsewhere, the following grades may be assigned, none of which yield grade points:

Grade	Definition
W	Withdraw
WP	Withdraw Passing
WF	Withdraw Failing
SAU	Audit (Satisfactory)
UAU	Audit (Unsatisfactory)
I	Incomplete

Grade Point Averages

Semester and cumulative averages are computed by dividing the total grade points earned by the total credit hours completed, i.e., all courses graded "A - F."

Incomplete Courses

A temporary grade of "I" may be assigned by an instructor only when the student is passing and has nearly completed the course, but because of circumstances beyond the student's control, the work is not completed. The incomplete grade must be resolved prior to the end of the semester following that in which the incomplete was received. At the request of the student and with a petition approved by the course instructor only, the incomplete may be extended one additional semester. If the incomplete is not resolved by the appropriate deadline, it will be changed to a grade of "I/F."

Academic Honors

PRESIDENT'S HONOR LIST

Students who carried 12 or more credits of coursework graded "A - F" and earned a minimum grade point average of 3.000 with no grades of "I" or "F" will be placed on the President's Honor List for that semester.

GRADUATION HONORS

Students will be graduated with the appropriate honor if the following criteria have been met:

A minimum of 30 credits of ESF and Syracuse University courses have been completed as a matriculated, upper-division student.

A cumulative grade point average of: 3.000 - 3.333, cum laude; 3.334 - 3.829, magna cum laude, 3.830 - 4.000, summa cum laude.

Academic Dismissal

Students who earn less than a 2.000 cumulative grade point average shall have their records reviewed by the Faculty Subcommittee on Academic Standards. Based on this review, the Subcommittee shall recommend to the President or his or her designee that each student with less than this minimum cumulative grade point average be either placed on academic probation or dismissed from ESF. The recommendation on probation or dismissal will be based upon an overview of the total academic record and the mathematical possibility for attaining a 2.000 cumulative average by the projected graduation date. The President or his or her designee will take final action and so inform each student in writing.

Each student dismissed will be given the opportunity to appeal that decision based on any extraordinary conditions which may have contributed to the student's unsatisfactory performance. This appeal must be made in writing and submitted to the Office of the Dean of Instruction and Graduate Studies within the stated time limit. Each appeal will be reviewed by the Faculty Subcommittee on Academic Standards which will recommend to the President or his or her designee either to sustain the dismissal or place the student on probation. The President or his or her designee will take final action and so inform each student in writing. There is no appeal beyond this process.

Students who have been dismissed for academic performance may not reapply until at least one semester has elapsed. Courses taken during the dismissal period may not be applied to the student's academic program.

Students dismissed a second time for academic performance may not again be considered for readmission.

Graduation Requirements

Students are responsible for meeting the following requirements for graduation:

1. Matriculated status as an undergraduate student.
2. All course requirements must be satisfied.
3. A minimum cumulative grade point average of 2.000 (4.000 = A) for all courses taken as a matriculated student at ESF.
4. At least 24 of the last 30 credits must be registered for through ESF.

5. Consistent with the State Education Department requirements, a total of at least 120 credits from courses accepted as transfer credit by ESF and courses successfully completed while a matriculated student at ESF.

Exceptions to Curriculum and Academic Policy Requirements

Exceptions to academic policies stated in this document and curriculum requirements may be made by the Faculty Subcommittee on Academic Standards which may delegate this authority. Exceptions may not violate standards established by the State University of New York or the State Education Department.

Exceptions must be requested on a petition form which must have a recommendation from the student's advisor and Faculty Chair or his designee. In those cases where an action is requested involving a specific course, the petition must also have a recommendation from the course instructor.

Graduation Rate

Of the transfer students who began their studies in the fall of 1987 at ESF, 83 percent received their degree, or continued in a five-year program, after four semesters of study. For those who began in the fall of 1987, approximately 82 percent received their degree, or are continuing in a five-year program, after four semesters of study. Further information on student retention is available from the Office of Instruction and Graduate Studies.

GRADUATE ACADEMIC POLICIES

Statement of Objectives

The objectives of graduate degree programs at ESF are to educate graduate students to (1) think critically and independently, (2) comprehend the processes of science and effectively apply scientific and professional procedures, (3) attain proficiency in the current level of knowledge in their respective fields, (4) become competent in the requisite technical skills and tools, (5) practice high standards of performance as scientists, educators, and professionals, and (6) exercise ethical conduct in their relationships with colleagues, other professionals, and the public.

Admission

GENERAL REQUIREMENTS

Admission to graduate studies is conditional upon review and acceptance of the applicant's credentials by appropriate Faculty members and upon the recommendation of the appropriate Faculty Chair to the Dean of Instruction and Graduate Studies. Employees of the College who carry faculty status in accordance with SUNY ESF faculty bylaws and are at or above the rank of assistant professor or equivalent, may not be in a matriculated status at the College. Required for admission are at minimum a bachelor's degree from a recognized institution, and generally an academic record showing at least a "B" average for junior and senior years of the baccalaureate program or for the master's program. Also required are Graduate Record Examination scores and for some degree programs, advanced test scores; supporting letters of recommendation; and a statement of educational and professional goals. The Graduate Record Examination may be waived by a Faculty on an individual basis.

INTERNATIONAL STUDENTS

The College accepts international students in graduate programs if they can satisfy regular admission requirements. In addition, those who do not have an undergraduate or graduate degree from a college or university at which English was the language of instruction, must demonstrate proficiency in the English language through achievement of a score of 5.50 or higher on the Test of English as a Foreign Language (TOEFL).

Degrees

MASTERS' DEGREES

Three master's degrees are offered at ESF: Master of Science, Master of Landscape Architecture, and Master of Forestry degrees. Degree requirements and program alternatives are listed below.

Master of Science (M.S.) and Master of Landscape Architecture (M.L.A.)

The Master of Science degree is an academic degree offered in the following degree programs: Forest Chemistry, Environmental and Forest Biology, Forest Resources Management, Environmental and Resource Engineering, and Environmental Science. Minimum requirements for the Master of Science degree are listed under Master's Degree Program Alternatives. The Master of Landscape Architecture degree is a professional degree offered in the Landscape Architecture degree program. The degree can be attained through all three program alternatives described below, with additional requirements as prescribed under the degree program.

MASTER'S DEGREE PROGRAM ALTERNATIVES

Master of Science and Master of Landscape Architecture

There are three program alternatives for the Master of Science and Master of Landscape Architecture degrees, namely:

PROGRAM ALTERNATIVE 1.
THESIS OR PROJECT AND DEFENSE

Under this program alternative, in addition to completion of necessary coursework, students prepare either (1) a research-oriented thesis which investigates a problem that initiates, expands or clarifies scientific knowledge in the field, or (2) an application-oriented project report that

applies skills or techniques from the field to address a specific problem. Whichever is chosen, students are required to define an appropriate problem for investigation; review relevant information; develop a study plan; collect, analyze and interpret data; test hypotheses and draw conclusions; and relate the results to scientific theory or body of knowledge in the field.

The minimum credit hour requirement is the successful completion of 30 credits distributed between coursework and thesis or project. The applicable distributions will be determined by individual Faculties to suit the programs, with the understanding that a minimum of 18 credits is awarded for graduate level coursework, including at least 12 credit hours of coursework taken in residence at ESF, and a minimum of 6 credits is awarded for the thesis. The student's study plan is approved by the major professor, steering committee and Faculty Chair. The student must successfully defend the thesis or project for degree completion. The thesis or project is prepared and bound according to College standards and deposited in Moon Memorial Library.

PROGRAM ALTERNATIVE 2. ACADEMIC OR PROFESSIONAL EXPERIENCE AND MASTER'S COMPREHENSIVE EXAMINATION

Under this program alternative, in addition to completion of necessary coursework, students participate in an academic or professional experience which enriches and complements the coursework of their study plan. Whatever the format of the program, its objectives, organization, procedures, and manner of documentation must be submitted in writing and must be approved by the student's major professor, steering committee, and Faculty Chair before the experience is begun.

The successful completion of a minimum of 24 credits of graduate level coursework is required for this program alternative, including at least 18 credit hours of coursework taken in residence. Additionally, a minimum of 6 credits (898) will be awarded for successful completion of the academic or professional experience, for a total minimum of 30 credits for this program alternative. The student must prepare a report satisfactory to the steering committee, and the student must pass a comprehensive examination covering the student's fields of study and academic or professional experience. The student's report on the academic or professional experience, prepared and bound according to College standards, will be maintained by the individual Faculty.

PROGRAM ALTERNATIVE 3. COURSEWORK AND MASTER'S COMPREHENSIVE EXAMINATION

The successful completion of a minimum of 42 credits of graduate level coursework is required for this program alternative, including at least 36 credit hours taken in residence. The student's study plan is approved by the Major Professor, steering committee and Faculty Chair. Upon completion of the coursework, the student must pass a comprehensive examination offering the student's fields of study.

Master of Forestry (M.F.)

The Master of Forestry degree is a professional degree offered in the Forest Management and Operations degree program. The degree is granted upon successful completion of 37 credit hours of graduate level coursework, as prescribed in the degree program. At the end of the program, the student must successfully complete a written comprehensive examination testing the student's knowledge of the material covered and the student's ability to analyze appropriate problems. No thesis or other product is required.

DOCTOR OF PHILOSOPHY DEGREE

General Requirements

The Doctor of Philosophy degree is an academic degree offered in the following degree programs: Forest Chemistry, environmental and Forest Biology, Forest Resources Management, Environmental and Resource Engineering, and Environmental Science. The Doctor of Philosophy (Ph.D.) degree requires a minimum of 60 graduate credits, of which 30 to 48 credits are for coursework and 12 to 30 credits are awarded for thesis. Individual Faculties will determine the applicable credit hour requirements within these ranges to reflect individual program requirements and emphases. The graduate credits earned for a master's degree that are applicable to a student's doctoral study plan are determined on an individual basis by the steering committee. The student must pass the doctoral candidacy examination covering selected fields of study at least one year prior to thesis defense, and successfully defend the thesis. The thesis must be prepared according to College standards and will be deposited in Moon Memorial Library.

Tool Requirements

Doctoral students must demonstrate competence in at least one research tool as a requirement for graduation. Such tools include statistics, computer science, or the ability to translate technical articles in a language other than English commonly used in science. Tool requirements and standards for each doctorate program will be determined by the corresponding program Faculty.

Student Advising and Study Plan

MAJOR PROFESSOR: APPOINTMENT AND RESPONSIBILITIES

The student's Major Professor is appointed by the Dean of Instruction and Graduate Studies, upon the recommendation of the Faculty Chair. A Major Professor should be appointed upon the student's matriculation into a graduate program. For the graduate student accepted into a graduate program but lacking a Major Professor, a temporary advisor

will be appointed by the Faculty Chair. However, every effort should be made to expedite appointment of a Major Professor as soon as possible.

It is the duty of the Major Professor to fulfill a primary role as the student's mentor. Aided by other members of the steering committee, the Major Professor guides the student in the development and implementation of the study plan, including course selection, research planning, choice of the professional experience, facilitation of the examination schedule, and reviews of thesis or project report drafts, including a complete review of the thesis or project report before the final copy is presented for defense.

STEERING COMMITTEE: APPOINTMENT AND DUTIES

The steering committee for all master's and doctoral students is composed of the Major Professor and at least two faculty members or other qualified persons. Other qualified persons include faculty at other institutions, or other recognized professionals.

The student's steering committee is appointed by the Dean of Instruction and Graduate Studies, upon the recommendation of the Faculty Chair. The steering committee should be appointed within the first semester. For all students, the steering committee must be established and must have met by the end of the third semester of graduate study.

The steering committee assists the student in the development of the study plan, including the development of the student's research, project or academic/professional experience. The steering committee guides the development of the thesis or project report, including a review of the thesis or project report before the final copy is presented for defense.

STUDENT'S STUDY PLAN

The student's study plan includes an individualized sequence of courses and a plan for research or project or academic/professional experience. The study plan, developed by the student with the advice and approval of the Major Professor and other members of the steering committee, must be submitted to the Faculty Chair for approval and then forwarded to the Dean of Instruction and Graduate Studies at least by the end of the third semester. The study plan can be changed during the course of each student's studies. Changes must be approved by the Major Professor, Faculty Chair, and the Dean of Instruction and Graduate Studies.

Examinations

MASTER'S COMPREHENSIVE EXAMINATION

The objectives of this examination are to determine the student's breadth and depth of knowledge in the chosen field of study, and to assess the student's ability to use that knowledge creatively and intelligently. Upon the recommendation of the appropriate Faculty Chair, the Dean of Instruction and Graduate Studies appoints the master's comprehensive examination committee consisting of the student's Major Professor, steering committee and at least one other faculty member from an appropriate area. Additionally, the Dean of Instruction and Graduate Studies appoints a committee chair who is not from the Faculty of the student's degree program. The examination has both oral and written components, with the exception that the Master of Forestry degree has a written component only.

The role of the examination committee chair is to manage the examination, ensure its integrity, and represent the interests of the faculty and students. Any member of the faculty may be an observer at the oral component of any comprehensive examination. The student examinee may invite a silent student observer to attend the oral examination.

Written Examination: The chair of the examination committee receives written questions or problems addressing the objectives of this examination. The committee chair reviews the questions and may convene the committee to discuss the examination and ensure that questions are appropriate and fair.

The Major Professor administers the written examination. Usually, one-half day is allocated to questions submitted by each examiner. Upon completion by the student, the examination questions are reviewed and graded by the committee members who prepared them. Then, the entire examination is reviewed by the examining committee.

Oral Examination: Where both oral and written components are required, the oral examination follows the written examination. This examination usually lasts two hours; however, the duration may be longer, if required. The questions may address written answers or other areas appropriate to the objectives of the examination. At the conclusion of the examination period, the student examinee and observers are excused from the room and the examining committee determines whether the student has passed the examination. Unanimous agreement is required to pass the student. If less than unanimous agreement is reached, the student is considered to have failed the comprehensive examination. The student can request a second examination. A student is considered to have passed the second examination if no more than one negative vote is cast. A student who has failed the second examination is terminated from the graduate program.

DOCTORAL PRELIMINARY EXAMINATION

The requirement for this examination is determined by individual Faculties. The purpose of this examination is to assess the entering student's basic knowledge in the chosen field of study. The results of this examination may be used to determine the student's suitability for the doctoral program and as a guide in selecting coursework and developing a program of study.

DOCTORAL CANDIDACY EXAMINATION

The objectives of this examination are to determine the student's breadth and depth of knowledge in the chosen field of study and to assess the student's understanding of the scientific process. The doctoral candidacy examination is taken when the majority of coursework is completed. This examination must be taken at least one year prior to the thesis defense.

Upon the recommendation of the appropriate Faculty Chair, the Dean of Instruction and Graduate Studies appoints the doctoral candidacy examination committee consisting of the student's Major Professor, the student's steering committee, and an additional faculty member from an appropriate area. Additionally, the Dean of Instruction and Graduate Studies appoints a committee chair who is not from the Faculty of the student's degree program. The examination must have both written and oral components.

The role of the examination committee chair is to manage the examination, ensure its integrity, and represent the interests of the faculty and student. Any member of the faculty may be an observer. The student examinee may invite a silent student observer to attend the oral examination.

Written Examination: There are two alternative forms for the written component, as follows:

Form 1: The chair of the examining committee receives written questions or problems addressing the objectives of this examination. The committee chair reviews the questions and may convene the committee to discuss the examination and ensure that questions are appropriate and fair.

The Major Professor administers the written examination. Usually, one-half day is allocated to questions submitted by each examiner. Upon completion by the student, the examination questions are reviewed and graded by the committee members who prepared them. Then, the entire examination is reviewed by the committee.

Form 2: The student prepares a written report on a topic or problem assigned by the examining committee. The topic or problem must meet the objectives of this examination and its content cannot be directly related to the student's thesis research. The student has approximately one month to develop a thorough understanding of the assigned topic and prepare a written report. The report is reviewed by committee members and committee chair.

Oral Examination: Following the written examination under Form 1, or completion of the report under Form 2, the committee meets with the student for an oral examination usually lasting two hours. However, the duration can be longer if required. The questions may address the report or other areas appropriate to the objectives of the examination, including subject matter in allied fields. At the conclusion of the examination period, the student examinee and observers are excused from the room and the examination committee determines whether the student has passed the examination. Unanimous agreement is required to pass the student. If less than unanimous agreement is reached, the student is considered to have failed the first doctoral candidacy examination. The student can request a second examination. A student is considered to have passed the second examination if there is no more than one negative vote. A student who has failed the second examination is terminated from the graduate program.

THESIS OR PROJECT DEFENSE EXAMINATION

Thesis: At the conclusion of the study and research program, each doctoral candidate or master's candidate completing a thesis under Program Alternative 1 must successfully defend the thesis. The objectives of the thesis defense examination are (1) to probe the validity and significance of the data and information presented in the thesis, (2) to assess the student as a critical thinker and data analyst, (3) to evaluate the student's scientific creativity, including the student's ability to relate research results to scientific theory within the chosen field, and (4) to present the results effectively in writing.

Project: Each master's candidate completing a project under Program Alternative 1 must successfully defend the project. The objectives of the project defense are (1) to determine how well the student has applied technical skills in problem solving, (2) to assess the student's creativity and innovation in developing the project, and (3) to evaluate the significance of the student's work in the context of professional theory and practice.

Upon the recommendation of the appropriate Faculty Chair, the Dean of Instruction and Graduate Studies appoints the thesis or project defense examination committee. It consists of members of the steering committee, and at least one additional faculty member for the master's degree examination and two additional faculty members or other qualified persons for the doctoral degree examination. Additionally, the Dean of Instruction and Graduate Studies appoints a committee chair who is not from the student's degree program.

This oral examination covers principally the material in the thesis or project, as well as literature and information relating to the thesis or project.

The role of the examination committee chair is to manage the thesis or project defense, ensure its integrity and represent the interests of the faculty and student. Any member of the faculty may be an observer. The student examinee may invite a silent student observer to attend the examination. The defense examination usually lasts two hours, although this time period may be extended as required. At the completion of the examination, the candidate and observers are excused from the room and the examination committee determines whether the candidate has

successfully defended the thesis. Unanimous agreement is required to pass the student. If less than unanimous agreement is reached, the student is considered to have failed the first doctoral defense examination. A student who fails the first defense may request a second defense. At the second defense, the student has passed the defense if there is no more than one negative vote. A student who has failed the second defense is terminated from the graduate program.

Evaluation

GRADES

For each course completed, one of the following grades will be awarded:

Grade	*Definition*	*Grade Points*
A	Excellent	4.000
A–		3.700
B+		3.300
B	Satisfactory	3.000
B–		2.700
C+		2.300
C		2.000
C–	Minimum Passing	1.700
F	Failure	0.000
I/F, I/U	Unresolved Incomplete	0.000

Under conditions defined elsewhere, the following grades may be assigned, none of which yield grade points:

Grade	*Definition*
W	Withdraw
WP	Withdraw Passing
WF	Withdraw Failing
S	Satisfactory
U	Unsatisfactory
SAU	Audit (Satisfactory)
UAU	Audit (Unsatisfactory)
I	Incomplete

GRADE POINT AVERAGES

Semester and cumulative averages are based on graduate level courses only and are computed by dividing the grade points earned by the credit hours completed in all courses graded "A - F."

INCOMPLETE COURSES

A temporary grade of "I" may be assigned by an instructor only when the student is passing and has nearly completed the course, but because of circumstances beyond the student's control, the work is not completed. The incomplete grade must be resolved prior to the end of the semester following that in which the incomplete is received. At the request of the instructor, under extraordinary conditions, the incomplete may be extended for one additional semester. If the incomplete is not resolved by the appropriate deadline, it will be changed to a grade of "I/F" or "I/U."

Academic Performance, Credit Hour Load, Transfer Credit, and Time Limits

ACADEMIC PERFORMANCE

All graduate students are required to maintain at least a 3.000 cumulative grade point average (4.000 = "A") for graduate level courses. Students who do not maintain this average, or who receive two or more grades of Unsatisfactory ("U") for work on the thesis or project, will be placed on probation or dismissed from ESF by the Dean of Instruction and Graduate Studies upon the recommendation of the College Subcommittee on Academic Standards.

CREDIT HOUR LOAD

To meet academic requirements, graduate students must be registered for at least one credit each semester, excluding summers, from the first semester of matriculation until all degree requirements have been completed. Students are required to register for at least one credit in the summer if they will complete all requirements during that time. There is no full-time credit hour load to meet academic requirements.

To qualify for various forms of financial support, the following credit hour loads are defined: Graduate students who hold an assistantship must be registered for at least nine credits each semester while holding such an award. Graduate students not holding an assistantship are considered full time if they are registered for at least 12 credits each semester.

Graduate students, holding an assistantship or not, in their last semester of study who have met all academic requirements except for the completion of their thesis or an examination may be considered full time if registered for at least one credit of thesis, professional experience, or independent study and have their major professor verify they are working full time on the completion of degree requirements.

TRANSFER CREDIT

Up to six credits of graduate coursework in which a minimum grade of B was earned from an accredited institution and not used to complete another degree may be accepted towards completion of a master's or doctoral degree as approved by the steering committee.

Time Limits

Graduate students must complete all requirements for the master's degree within three years of the first date of matriculation. For the doctoral degree, students must complete all degree requirements within three years of passing

the doctoral candidacy examination, or they will be required to retake the candidacy examination.

Procedures for Review, Grievance, Dismissal, Appeal, and Reapplication

Procedures for review, grievance, dismissal, appeal and reapplication, as developed by the ESF faculty within SUNY guidelines, will be publicized in the *Graduate Student Handbook*.

Area of Study

The general area of study for each master's or doctorate student is implied by the title of the program in which the degree is awarded. Areas of study may be established within degree programs by individual Faculties that further define the student's area of specialization. The student's area of study is listed on the student's transcript if identified on the study plan.

Additionally, each Faculty may offer minors identifying ancillary areas of study that may be appropriate for the degree program. A minor is equivalent to 12 or more graduate credits earned in the minor area. Courses in a minor area must be taken outside of the student's area of study. A minor is identified on the student's transcript. A Minor Professor must be appointed to the student's steering committee for each minor elected, in addition to the minimum complement of steering committee members. Each Minor Professor can replace an additional examiner.

Competency in Communication Skills and Graduate Seminars

COMMUNICATION SKILLS

All students entering graduate programs at ESF are expected to be proficient in communication skills, including technical writing and library skills. Students are required to have completed at least one course in technical writing and one course in library usage, either as an undergraduate or as a graduate student. Credits for such courses taken during the graduate program are not counted towards degree requirements. Alternatively, graduate students can meet the requirement by demonstrating the equivalent in experience in writing and library skills, as determined by the steering committee.

SEMINARS

Participation in seminars, including the preparation and presentation of technical material, is vital to the student's graduate education. All graduate students at ESF are required to participate in graduate seminars, as follows:

Topic Seminar

Each graduate student is expected to participate in topic seminars, including presentations, as determined by the individual Faculty. This requirement can be fulfilled, with appropriate approval, by seminars offered at Syracuse University or the SUNY Health Science Center at Syracuse.

Capstone Seminar

Students completing the master's degree under Program Alternative 1 or 2, or the Ph.D. degree, are required to present a "capstone seminar" on their thesis or project research, academic, or professional experience. Masters' students under Program Alternative 3 are required to present a capstone seminar on a topic chosen in consultation with the Major Professor and steering committee. The purpose of the capstone seminar is to provide an opportunity for the graduate student to present technical information to a critical body of professionals and peers. This seminar will be presented prior to the thesis defense or comprehensive examination and should be attended by the student's steering committee. Each seminar is open to the College community and will be announced collegewide to encourage attendance by students and faculty.

Numbering System for Graduate Courses and Shared Resource Courses

Courses at ESF are numbered according to the following system:

100-499 Undergraduate courses for which no graduate credit may be given.

500-599 Graduate courses designed expressly for areas of specialization in post-baccalaureate programs or in the professional program leading to the Bachelor of Landscape Architecture. Qualified undergraduate students may enroll by permission of the instructor.

600-699 Graduate courses designed expressly for advanced levels of specialization. Undergraduate students with a cumulative grade point average of 3.000 or better may enroll in these courses with an approved petition.

700-999 Advanced graduate level courses for which no undergraduate students may register.

Shared resource courses, designated as 400/500 or 400/600, are designed when the topic coverage of both courses is the same. Separate course syllabi are developed expressly differentiating the requirements and evaluative criteria between the undergraduate course and the graduate course. No type of crosslisting may be offered unless approved by the ESF faculty.

Standards for Theses, Projects, and Professional Experience Reports

Collegewide standards for theses, projects, and professional experience reports are developed and specified by the Moon Memorial Library Faculty in consultation with the various Faculties and are available in the Office of the Dean of Instruction and Graduate Studies.

STUDENT LIFE

HOUSING

The College of Environmental Science and Forestry does not operate its own residence facilities or food service. ESF students may contract with Syracuse University Residence Services, the residence halls at the SUNY Health Science Center, or any of the large number of off-campus housing choices.

Syracuse University housing is within walking or free shuttle bus distance to the ESF campus. Students have a choice of living centers which include large halls, apartment houses, cottages, fraternity and sorority houses, or cooperative units. Freshmen and sophomores typically are assigned to north campus residences; upperclassmen are assigned to the south campus area. Student resident advisors live on each floor or in each unit and are available for counseling, advisement, and referral services. Contracts for room and board made with Syracuse University cover a full academic year—both fall and spring semesters—and are not normally renegotiable during that time period.

Syracuse University also has housing units available for married students and their families in the south campus area.

For more specific information about costs and availability, students should contact the Director of Residence Services, 202 Steele Hall, Syracuse University, Syracuse, New York 13244, (315) 443-2721).

Housing is also available at the SUNY Health Science Center located within easy walking distance of the ESF campus. Accommodations are fully furnished, and options include standard residence hall rooms, studios, and one-bedroom apartments. For more specific information about costs and availability, students should contact the Director of Residence Life, 175 Elizabeth Blackwell Street, SUNY Health Science Center at Syracuse, Syracuse, New York 13210, (315) 473-5106).

Students who wish to live off-campus should contact the Alternative Action Services (ALTERACTS), a student-run housing organization at Syracuse University, housed in the Schine Student Center. An extensive listing of available housing in the Syracuse area is provided free of charge.

FOOD SERVICE

Syracuse University offers different meal plans to help meet the varying nutrition needs and interests of individual students. Students living in University apartments, co-ops, fraternities and sororities or off-campus can take advantage of the board plans available. Students living in residence halls and area housing without full kitchen services are required to subscribe to a board plan.

The College does not provide a food service program. However, The Gallery, located in the basement of Marshall Hall, is open 8 a.m. to 3:30 p.m. weekdays during the academic year, and offers quick snacks and light meals.

EXTRACURRICULAR ACTIVITIES

Students at the College of Environmental Science and Forestry have many extracurricular activities to choose from, on both the ESF and SU campuses and in the Syracuse community.

At the College

The Undergraduate Student Association (USA) and the Graduate Student Association (GSA) are the official representative bodies on campus governing student activities. Undergraduate and graduate students elect representatives from each Faculty to manage the affairs of their respective organizations and respond to the concerns of their constituents.

Funded by student activity fees, these two organizations sponsor a variety of annual events, such as the All-College Welcome Back Picnic held the first weekend of the fall semester; the Fall Barbeque, a day of informal team competition and outdoor fun; the Spring Awards Banquet, where students, faculty, and staff are recognized for their contributions to the College community, and several all-college "TGIF's" during each semester.

Campus organizations offer students an opportunity to broaden their knowledge, gain leadership skills and experience, and meet other students with similar personal and academic interests. These organizations include such groups as: the Bob Marshall Club, an organization of students concerned about the future of the Adirondack Mountains; the Forestry Club, sponsor of the intercollegiate Woodsmen's Team; Forest Engineers Club; Mollet Club, an organization of landscape architecture students; Papyrus Club; and the Recycling Club. Other student organizations include honor society Alpha Xi Sigma, which sponsors campus service activities and such campuswide events as College Bowl; Alpha Phi Omega, a service and social fraternity; and Kappa Phi Delta, an ESF-affiliated social-professional fraternity located on the Syracuse University campus.

There are also student chapters of The Wildlife Society, the Society of American Foresters, the American Chemical Society, the American Fisheries Society, the American Society of Landscape Architects, the Associated General Contractors, the Technical Association of Pulp and Paper Industries (TAPPI), and the Association for Women in Science (AWIS).

The two major student publications at ESF are the *Knothole*, a weekly newspaper, and the *Empire Forester*, an annual yearbook which has won several awards in past years.

The Graduate Student Association sponsors a professional lecture series, and a number of social events enjoyed by graduate students, staff, and faculty. For more information, contact the Office of Activities and Organizations, 110 Bray Hall, (315) 470-6658.

At Syracuse University

Students at the College of Environmental Science and Forestry have all the privileges of Syracuse University students: participation in student government, organizations, sports, and other extracurricular activities.

ESF students can participate in Syracuse University club sports and intramurals. Archbold and Flanagan Gymnasium on the Syracuse University campus is the center of athletics and physical education. Additional indoor facilities are provided through Manley Field House and the Carrier Dome, the site of Syracuse University home football, basketball, and lacrosse games. Facilities at Skytop recreation area include a lodge and 22 tennis courts. The Women's Building offers instructional, social, and recreational facilities. All full-time undergraduate women are eligible to participate in intercollegiate competition in tennis, field hockey, volleyball, basketball, swimming, and diving.

Students are provided with many opportunities for acquiring musical training and performing experience through the Syracuse University Band, the Syracuse University Orchestra, and the Syracuse University Chorus.

Membership is allowed in all Syracuse University student groups, including a wide variety of clubs, the International Student Association, religious and military organizations, and professional and honor societies.

In the Syracuse Area

The City of Syracuse and its surrounding countryside offer many cultural, educational, and recreational opportunities. The city has several fine museums, including the Everson with its outstanding collection of works by local, regional, and international artists; Syracuse Stage, a local repertory theater; a professional symphony orchestra; and a Civic Center which attracts performing artists from around the world.

Eight parks lie within the city limits, and numerous county and state parks, including Beaver Lake Nature Center and Montezuma National Wildlife Refuge are within a short drive. Downhill and cross-country skiing facilities are also within driving distance of the College.

COLLEGE SERVICES

Career and Counseling Services

The Office of Career and Counseling Services is available throughout the students' college career as a place where at any time they may seek the advice of experienced counselors. This office should be the first contact when questions or personal problems arise. Severe problems requiring extensive assistance are referred to the cooperative facilities at Syracuse University and/or specialized agencies in Syracuse.

The Office is designed to provide assistance to students throughout the year to help them adjust to and successfully graduate from ESF. Through various presentations, counseling sessions, group activities and workshops, students are given the opportunity to develop such skills as decisionmaking, studying, and test taking. Additional programs deal with adjustments related to college entrance, transferring colleges and exploring relationships between academic difficulties, learning disabilities, or adjustment problems.

A key component of this office is to provide a variety of opportunities through resource materials, presentations, job development, and counseling to meet the individual needs of each student at his/her various stages of career readiness. Some career services offered through this Office are skills development workshops; list of full-time, part-time, and summer jobs; on campus recruiting; company literature; career newsletters; reference information; and an alumni job list.

Each year this office conducts a Placement Survey to monitor the success and progress of our college graduates. The reports are shared with the college community and made available to the public upon request from the Office of Counseling and Career Placement in Room 110, Bray Hall.

Academic Support

Academic support services are available through the SU Academic Support Center for learning disabled students, as well as students requiring tutorial and remedial assistance. Students with identified learning disabilities should contact the Office of Student Affairs and Educational Services as soon as possible so that appropriate services may be provided. Contact Mr. Thomas Slocum, 110 Bray Hall, (315) 470-6658.

Services for the Handicapped

Students who experience short-term handicaps and/or incapacitating injuries that require special transportation or classroom assistance should contact the Office of Student Affairs.

The Office of Administration and Services, assisted by Student Affairs, also provides specialized support services and adapts general resources to assist more permanently handicapped students to obtain maximum academic, social, and cultural benefits within the College community. Some of the specific services provided or made available include: pre-admissions guidance, orientation, mobility training, reader recruitment, preferential housing assignments, tutoring and other supportive services as required to meet individual living/learning needs. The College is also prepared to respond to handicapped students' needs for personal and career counseling and job placement assistance.

For further information, contact the ESF 504 Coordinator, Mr. Nick Paradiso, Office of Administration and Services, Room 209, Bray Hall, (315) 470-6622. The College maintains liaison relationships with rehabilitation agencies within the local community and the state,

including the Office of Vocational Rehabilitation and the Commission for the Visually Handicapped. For specific information regarding their own eligibility, students should contact the respective agency directly.

Health and Medical Facilities

Students may consult a physician for medical care or health advice at the Syracuse University Student Health Service. Full-time students are entitled to unlimited visits to the out-patient clinic and also 10 days of confinement per college year with ordinary medical care in the infirmary. Infirmary usage over 10 days will be at prevailing infirmary rates. Some laboratory examinations, if necessary for treatment or diagnosis of common illness, are provided without cost. Most common legal drugs are provided at a minimal charge.

A student accident or sickness insurance plan, available at fall registration, not only supplements the usual infirmary privileges, but is also a health protection plan during the summer months when students are not under the care of the Health Service. Married students with dependents who are not covered by Health Service privileges are strongly urged to provide themselves and their families with special insurance made available to University students. All international students, as well as faculty and students planning to study abroad, are required to carry the SUNY-supplied health and accident insurance. Further details about this SUNY-supplied policy is available from the ESF Office of Student Affairs in 110 Bray Hall, (315) 470-6658 or from Syracuse University's International Student Office, 310 Walnut Place, (315) 443-2457.

SU Speech and Hearing Clinics

The Gebbie Speech and Hearing Clinics provide remedial assistance to all regularly enrolled students who may be handicapped by hearing, speech, and voice disorders. This service is free to students.

SU Psychological Services and Research Center

Students desiring an analysis of their aptitudes, abilities and interests may secure special testing programs at the Testing and Evaluation Service Center on the Syracuse University campus.

SU ROTC Opportunities

Students attending the College are eligible to participate in the Army or Air Force ROTC Program at Syracuse University.

ROTC at Syracuse University consists of both 4- and 2-year programs. Students attending the College for two years can gain admission to either the Army or Air Force program through participation in summer training. Both six-week and four-week camps and on-campus programs are available to suit individual needs.

The ROTC programs offer academic instruction, alternate and supplementary career opportunities, leadership experience and financial aid.

ESF Alumni Association

The Alumni Office serves as the liaison between the College, the Alumni Association Board of Directors and more than 9,000 alumni. The Association supports education programs through scholarships, publishes a quarterly newsletter and represents alumni concerns.

ESF Student Rules and Regulations

The complete listing of guidelines for all students attending ESF is found in a separate publication, the *Student Handbook*, which is distributed at the beginning of the semester. "Rules and Regulations of Conduct and Behavior" which pertains to all students is included in the *Handbook*. It is the student's responsibility to be familiar with these regulations and abide by them.

Freshman Residency Program

The College of Environmental Science and Forestry accepts a limited number of students into a Freshman Residency Program which prepares them to enter many of the upper division programs of the College. Students interested in this program should refer to page 15 for information on freshman admissions.

Students who meet the admissions criteria and are interested in pursuing a degree in Environmental and Forest Biology, Resource Management, the dual major of Environmental and Forest Biology and Resource Management, or Chemistry should review the Sciences and Management Track on page 40. Those students interested in Paper Science and Engineering, or Forest Engineering should review the Sciences and Engineering Track on page 39.

Students accepted into either of these tracks complete the required program through a combination of courses taken at ESF, Syracuse University, or advanced standing granted through AP, CLEP, and other appropriate programs.

Sciences and Engineering Track

For those students entering the Sciences and Engineering Track with the intention of pursuing the upper division program in Paper Science and Engineering, the following guidelines should be considered when planning their program.

Electives taken throughout the full four-year curricula must include at least nine credit hours in social sciences or humanities, at least three of which are recommended to be upper division. Humanities coursework deals with branches of knowledge concerned with man and his culture, while social sciences coursework concerns individual relationships in and to society. Traditional subjects in these areas are philosophy, religion, history, literature, fine arts, sociology, psychology, anthropology, economics, and modern languages beyond the introductory skills courses, while modern nontraditional subjects are exemplified by courses such as technology and human affairs, history of technology, and professional ethics and social responsibility. Subjects such as accounting, industrial management, finance, personnel administration, ROTC studies, and skills courses, such as public speaking and technical report writing, do not fulfill the humanities and social science content.

Students having advanced placement credits are encouraged to work closely with their advisor in order to best prepare for various upper division elective sequences in technology, science, design or management.

Sciences and Management Track

For those students entering the Sciences and Management Track with the intention of pursuing the upper division program in Environmental and Forest Biology, Resource Management, or the dual major of Environmental and Forest Biology and Resource Management, the following guidelines should be considered when planning their program.

Environmental and Forest Biology: Electives taken throughout the full four-year curriculum must include at least nine credits of social sciences/humanities. Electives must also include one course from each of Groups A and B listed below. Students must also take a minimum of six credits each of animal and plant sciences; these may include courses from Groups A and B not used as noted above. Finally, a minimum of nine credits in biology at the upper division (numbered 300 or higher) are required.

Group A	Group B
Elements or Principles of Entomology	Dendrology 1
Invertebrate Zoology	Plant Diversity
Environmental Microbiology	Forest Pathology

Students must also take the soils course or one of the following: Geology, climatology, earth science, or meteorology.

Resource Management: Electives taken throughout the full four-year curriculum must include at least nine credits of social sciences (anthropology, economics, geography, history, political science, sociology, and psychology); nine credits of humanities (art, music, foreign languages, philosophy, and literature); nine credits dealing with at least two major resources (forage, minerals, recreation/amenities, water, wildlife, and wood); and another three credits in the area of forest protection (entomology, pathology, and fire). Of the total of 42 credits of electives in the four-year curriculum, at least six credits must be taken in two or more of the faculties at ESF other than Forestry.

Students may take PSC 122, American State and Local Government and Politics in place of or concurrent with PSC 121, American National Government and Politics.

Dual Major in Environmental and Forest Biology and Resource Management: Electives taken throughout the full four and a half year curriculum must include at least nine credits of social sciences/humanities; one course from each of Groups A and B (as listed above); must include a minimum of six credits each of animal and plant sciences; a protection course (entomology, or pathology if not chosen from Groups A and B; otherwise this becomes a biology upper division elective); and a minimum of nine credits of upper division (number 300 or higher) biology.

Students may take PSC 122, American State and Local Government and Politics in place of or concurrent with PSC 121, American National Government and Politics.

Sciences and Engineering Track

Freshman Year

Fall

EFB	226	General Botany	4
CHE	106	General Chemistry	3
CHE	107	General Chemistry Lab	1
MAT	295	Analytical Geometry & Calculus	3
WRT	105	Writing Studio	3
ESF	132	Seminar for New Students	1
		Elective-- Hum/Soc Sci	3
			18

Spring

PHY	211	Physics I	3
PHY	221	Physics Lab I	1
CHE	116	General Chemistry	3
CHE	117	General Chemistry lab I	1
MAT	296	Calculus II	3
EFB	220	Global Environment	3
APM	155	Computing Methods	3
			17

Sophomore Year

Paper Science and Engineering

Fall

PHY	212	Physics II	3
PHY	222	Physics Lab II	1
FCH	221	Organic Chemistry I	3
FCH	222	Organic Chemistry Lab I	2
MAT	397	Calculus III	3
FOR	206	Micro Economics	3
PSE	300	Introduction to Pulp & Paper	3
			18

Spring

FCH	223	Organic Chemistry II	3
FCH	224	Organic Chemistry Lab II	2
CHE	332	Quantitative Analysis	2
CHE	333	Quantitative Analysis Lab	1
ENG	141	Reading & Interpretation	3
MAT	585	Differential Equations	3
		Elective--Hum/Soc Sci	3
			17

Forest Engineering

Fall

PHY	212	Physics II	3
PHY	222	Physics Lab II	1
ERE	221	Engineering Mech - Statics	3
ERE	225	Engineering Graphics	1
MAT	397	Calculus III	3
FOR	206	Micro Economics	3
		Elective--Hum/Soc Sci	3
			17

Spring

ERE	362	Mechanics of Materials	3
ERE	222	Engineering Mech - Dynamics	2
MAT	398	Calculus IV	3
ELE	221	Electrical Science I	3
ENG	141	Reading & Interpretation	3
FOR	205	Macro Economics	3
			17

Sciences and Management Track

Freshman Year

Fall

EFB	226	General Botany	4
CHE	106	General Chemistry	3
CHE	107	General Chemistry Lab	1
MAT	295	Analytical Geometry & Calculus	3
WRT	105	Writing Studio	3
ESF	132	Seminar for New Students	1
		Elective-- Hum/Soc Sci	3
			18

Spring

EFB	285	Principles of Zoology	4
CHE	116	General Chemistry	3
CHE	117	General Chemistry Lab	1
EFB	220	Global Environment	3
ENG	141	Reading & Interpretation	3
APM	155	Computing Methods	3
			17

Sophomore Year

Environmental and Forest Biology

Fall

PHY	211	Physics I	3
PHY	221	Physics Lab I	1
EFB	320	General Ecology	3
FCH	221	Organic Chemistry I	3
FCH	222	Organic Chemistry Lab I	2
		Elective--Hum/Soc Sci	3
			15

Spring

FOR	345	Soils		3
PHY	212	Physics II	3	3-12
PHY	222	Physics Lab II	1	
		and/or		
FCH	223	Organic Chemistry II	3	
FCH	224	Organic Chemistry Lab II	2	
		and/or		
MAT	296	Calculus II	3	
		Elective--Biology		3-9
				15-18

Resource Management

Fall

PHY	211	Physics I	3
PHY	221	Physics Lab I	1
EFB	320	General Ecology	3
FOR	200	Intro to Resource Management	2
FOR	206	Micro Economics	3
		Elective--Hum/Soc Sci	5
			17

Spring

FOR	345	Soils		3
PSC	121	Amer Nat Government & Politics		3
SOC	101	Social Perspectives	3	3
		or		
PSY	205	Foundations of Human Behavior	3	
		Elective--Hum/Soc Sci		8
				17

Dual Major -- Environmental and Forest Biology and Resource Management

Fall

PHY	211	Physics I	3
PHY	221	Physics Lab I	1
EFB	320	General Ecology	3
FCH	221	Organic Chemistry I	3
FCH	222	Organic Chemistry Lab I	2
FOR	206	Micro Economics	3
		Elective--Hum/Soc Sci	3
			18

Spring

FOR	345	Soils		3
PHY	212	Physics II	3	3-5
PHY	222	Physics Lab II	1	
		and/or		
FCH	223	Organic Chemistry II	3	
FCH	224	Organic Cemistry Lab II	2	
		and/or		
MAT	296	Calculus II	3	
PSC	121	Amer Nat Government & Politics		3
		Elective--Hum/Soc Sci		6
				15-17

Chemistry

Fall

PHY	211	Physics I	3
PHY	221	Physics Lab I	1
FCH	221	Organic Chemistry I	3
FCH	222	Organic Chemistry Lab I	2
FOR	206	Micro Economics	3
SPC	225	Speech	3
		Elective--Hum/Soc Sci	3
			18

Spring

FCH	223	Organic Chemistry II	3
FCH	224	Organic Chemistry Lab II	2
PHY	212	Physics II	3
PHY	222	Physics Lab II	1
MAT	296	Calculus II	3
		Elective--Hum/Soc Sci	3-6
			15-18

Degree Programs and Areas of Study

The College is authorized to award degrees in the following programs. Enrollment in other than registered or otherwise approved programs may jeopardize a student's eligibility for certain financial aid programs.

Division of Engineering, p. 42

Environmental and Resource Engineering; M.S., Ph.D., with areas of study in environmental management, chemistry of pulping and bleaching, colloid chemistry and fiber flocculation, fiber and paper mechanics, forest engineering, geo-spatial information systems, photogrammetry and remote sensing, process and environmental systems engineering, pulp and paper technology, water resources engineering, wood science and technology, wood anatomy and ultrastructure, tropical timbers, wood treatments, engineered wood products and structures: earthquake engineering, or engineered wood products and structures: timber structure design. (HEGIS Code 0999)

Division of Forest Resources, p. 46

B.S., Dual Program in Environmental and Forest Biology/Resource Management. (HEGIS Codes 0999 and 0115)

Faculty of Chemistry, p. 48

Chemistry; B.S., with options in biochemistry and natural products chemistry, environmental chemistry, or natural and synthetic polymer chemistry. (HEGIS Code 1905)

Forest Chemistry; M.S., Ph.D., with areas of study in biochemistry and natural products chemistry, environmental chemistry, or natural and synthetic polymer chemistry. (HEGIS Code 1905)

Faculty of Environmental and Forest Biology, p. 51

Environmental and Forest Biology; B.S., with elective concentrations in ecology, entomology, environmental microbiology, fish and wildlife biology and management, pest management, plant physiology, plant science, zoology and an accelerated B.S./M.S. in plant biotechnology.

Environmental and Forest Biology; M.S., Ph.D., with areas of study in ecology, entomology, environmental physiology, fish and wildlife biology and management, forest pathology and mycology, plant science and biotechnology, soil ecology, or chemical ecology. (HEGIS Code 0499)

Faculty of Environmental Studies, p. 56

Environmental Studies; B.S. (HEGIS Code 0201)

Graduate Program in Environmental Science; M.S., Ph.D., with areas of study in land resources, water resources, and environmental communications. (HEGIS Code 0420)

Faculty of Forest Engineering, p. 60

Forest Engineering; B.S. (HEGIS Code 0999)

Faculty of Forestry, p. 62

Forest Technology Program; A.A.S. (HEGIS Code 5403)

Resource Management—General Forestry; B.S. (HEGIS Code 0115)

Forest Management and Operations; M.F., with areas of study in the public sector, or the private sector. (HEGIS Code 0115)

Forest Resources Management; M.S., Ph.D., with areas of study in policy and administration, forestry economics, forest management, recreation management, watershed management/hydrology, silviculture, silvics, forest soil science, tree improvement, international forestry, urban forestry, quantitative methods, or resources information management. (HEGIS Code 0115)

Faculty of Landscape Architecture, p. 72

Landscape Architecture; B.L.A. (HEGIS Code 0204)

Landscape Architecture; M.L.A. (HEGIS Code 0204)

Faculty of Paper Science and Engineering, p. 77

Paper Science and Engineering; B.S., with options in science or engineering. (HEGIS Code 0999)

Faculty of Wood Products Engineering, p. 81

Wood Products Engineering; B.S., with options in construction, or wood science and technology. (HEGIS Code 0999)

DIVISION OF ENGINEERING

ROBERT H. BROCK, *Director*
312 Bray Hall
(315) 470-6633

Graduate Program in Environmental and Resource Engineering

Robert V. Jelinek
Graduate Studies Coordinator
208 Walters Hall
(315) 470-6519 / 6502

The graduate program in Environmental and Resource Engineering (ERE) is concerned with the application of science and engineering to the conservation, restoration, holistic development, and improved utilization of the natural environment and its forest-related resources. It represents synthesis of the professional specialties of three academic faculties which comprise the Division of Engineering. These are the Faculty of Forest Engineering (FEG), the Faculty of Paper Science and Engineering (PSE), and the Faculty of Wood Products Engineering (WPE).

The Master of Science and Doctor of Philosophy degrees are awarded in ERE.

The College policies for graduate admission and graduate academics are given on pages 18 and 29. Graduate students in the Division of Engineering generally follow these policies. The minor exceptions are given below.

The Graduate Record Examination is encouraged and expected, but may be waived in exceptional circumstances, on an individual basis. Applicants are required to have a bachelor's degree in science or engineering. At least one year of study in each of the following subjects is expected: biological science, calculus, chemistry, computer science and physics.

With reference to the Master of Science degree in Environmental and Resource Engineering, only Program Alternative 1 (Thesis or Project and Defense) and a minimum of 30 credit hours are accepted. Details for Program Alternative 1 and the distribution of the required 30 credit hours are given on page 29.

Under General Requirements for the Ph.D. degree (page 30), the Environmental and Resource Engineering Program requires a minimum total of 60 graduate credits, to include a minimum of 30 credits of coursework, and allow a maximum of 30 credits for thesis. As tool requirements, students must demonstrate competence in two of the three following areas: computer science, statistics or advanced mathematics, and a language other than English commonly used in science or engineering practice. The Doctoral Preliminary Examination is required of all students who have not earned a master's degree corresponding to the above Alternative 1.

A study plan which formally identifies an individual student's program requirements is developed for each student as soon as possible, but at least during the first year of graduate study. This plan includes all required and elective courses as well as a tentative schedule for completion.

Areas of study, and study plans are all developed and implemented using, as necessary, the full resources of the Division of Engineering, the College of Environmental Science and Forestry, Syracuse University, and other SUNY institutions.

Areas of Study

Several areas of study in the Environmental and Resource Engineering program are described below, which emphasize current faculty and student interest and activity. These examples are not meant to give the full range of faculty interest. Some students have programs encompassing two or more areas of study.

Environmental Management

Participating Faculty: DUGGIN, HASSETT, HOPKINS, JELINEK, LEE, MCCLIMANS, PALMER, SMITH, TOLL, and select non-engineering faculty

- Environmental Modeling
- Waste Management
- Energy resources and systems
- Business policy and administration
- Project impact mitigation
- Public policy and environmental regulation

Environmental Management is an option available to M.S. students residing in any of the three engineering faculties, regardless of their "major" area of interest. Required courses in management, waste management, and environmental law provide breadth and perspective for the student aspiring to managerial responsibility in public or private employment. Other courses may be recommended to enhance technical and problem-solving competencies.

Chemistry of Pulping and Bleaching

Participating Faculty: DENCE, FRANCIS, JELINEK, LAI, SCHROEDER

- Reaction mechanisms and kinetics
- Applications of biotechnology
- Chemical modification in mechanical pulping
- Catalytic and activation effects

This area of study focuses on chemical relationships and reactions basic to the manufacture and bleaching of paper pulp, as well as some papermaking operations. Courses in theoretical and applied chemistry are indicated, as well as specialized courses addressed directly to pulping and bleaching. Research centers on these same topics, currently stressing new and improved processes to increase energy efficiency and reduce environmental impact. These include studies of organosolve pulping, delignification and brightening with oxygen, hydrogen peroxide and ozone, enzyme treatment of effluent streams, mechanisms of carbohydrate reactions, and photosensitization of bleached pulps.

Colloid Chemistry and Fiber Flocculation

Participating Faculty: BAMBACHT, HOLTZMAN, LUNER, UNBEHEND

- Paper sheet formation mechanisms
- Wet-end chemistry and physics

- Pulp fines characterization and distribution
- Effects of additives in fiber networks

This study area deals with colloidal phenomena in the papermaking process, in particular the interaction between fibers, fine particles, polymeric additives, and electrolytes in stock preparation and sheet formation. Student programs feature courses in colloid, polymer and physical chemistry, adding appropriate work in mathematics, statistics, and papermaking processes. Research topics fall into two categories: a) fundamental colloidal behavior of particles and b) behavior of paper stock on the paper machine. In the latter, extensive use is made of pilot plant facilities in Walters Hall. Presently under investigation are adsorption-desorption behavior of polymers in papermaking, the chemistry and physics of reactive sizes on model surfaces, and effects of turbulence on sheet formation.

Fiber and Paper Mechanics

Participating Faculty: CÔTÉ, CROSBY, EUSUFZAI, HANNA, KYANKA, LUNER, MARK, THORPE, UNBEHEND

- Fiber orientation and sheet properties
- Micromechanics theory and applications
- Effects of refining and mechanical action
- Microscopy and image analysis techniques

Mechanical behavior of fibers, paper and board, and other fiber networks and composites depends upon variables of material, process and structure at all levels, especially structural anisotropy. Recommended courses focus on mechanics of materials, physics, mathematics and statistics, microscopy, and wood and fiber properties. Research topics are basic in nature, designed to describe and model quantitatively the properties and behavior of fibers and fibrous structures. Current projects include properties of recycled fiber papers, measuring fiber stiffness via image analysis, laser speckle interferometry in strain mapping, effects of beating and fines distribution on wet-web strength, and determination of elastic constants of paper. Several members of the Engineering Faculty of Syracuse University collaborate closely in this work.

Forest Engineering

Participating Faculty: LEE, PALMER

- Mechanization, automation, robotics
- Production management and efficiency
- Site modification
- Access design and construction

A modern update and broadening of the traditional areas of logging and harvesting. Emphasis is placed on engineering approaches to the design and analysis of operational systems for such activities as harvesting, construction, transportation, and land management. Graduate programs are based on a familiarity with operations research models, especially simulation techniques; mechanical and man-machine systems; biologic-geologic interactions; and various selections as needed from the array of engineering sciences.

Geo-spatial Information Systems

Participating Faculty: BROCK, DUGGIN, HOPKINS

- Spatial data acquisition
- Environmental database development
- Environmental modeling
- Site selection and facility design

This program emphasizes current approaches to using Geo-spatial Information Systems (GIS) to better incorporate spatial data into a wide range of environmental and engineering applications. Both theoretical and applied graduate study focuses on mapping fundamentals, spatial data acquisition techniques, GIS concepts, theory of spatial analysis and modeling, and environmental applications. Additional educational opportunities include systems analysis, environmental sciences and management, automated cartography, computer science, database systems, and information management.

GIS core courses include spatial data acquisition, courses dealing with GIS concepts and theory, a GIS project, and statistics. These courses may be supplemented by many other courses and educational opportunities at ESF and Syracuse University (SU). Graduate study may be integrated with the wide range of engineering, environmental, and resource management study areas at ESF. For example, GIS study can be expanded to hydrologic modeling, photogrammetry and remote sensing, forest management, environmental engineering, and development and location of facilities. Ample flexibility allows programs to be tailored to the interests and strengths of individual students.

Facilities are excellent and expanding, with computers at ESF and Syracuse University, including the SU Advanced Graphics Research Lab. Capabilities include numerous GIS based on a range of computing platforms and offering wide-ranging capabilities for both raster and vector processing. One of the most important GIS resources are the extensive forest properties owned and managed by ESF. These properties provide exceptional opportunities for environmental research and practice with incredible amounts of current and historical data. Related capabilities include advanced image processing systems and a wide range of photogrammetry, remote sensing, and surveying equipment and expertise. Impressive facilities for visual assessment and simulation, parallel and super computing, graphics, and cartography are also available.

Students with engineering, science, or geography backgrounds are particularly suited to this program of study. Numerous opportunities exist for research and financial support. Cooperative and contractual arrangements exist with many organizations, including local and state government agencies, federal agencies such as the U.S. Department of Agriculture, and private engineering and environmental planning firms. Employment opportunities are exceptional.

Photogrammetry and Remote Sensing

Participating Faculty: BROCK, DUGGIN, HOPKINS

- Analytical and digital photogrammetry
- Resources monitoring and assessment
- Digital image processing and classification
- Remote sensing systems analysis

This program provides opportunities for both theoretical and applied graduate study in sensing systems and the location, measurement, analysis, and description of ground features and earth resources. Studies include in-depth coverage of photographic systems, photogrammetric measurement techniques and applications, and visual image analysis. Digital imaging systems are covered extensively, with an emphasis on earth-orbiting sensors. Advanced courses in photogrammetry and digital image analysis cover theory and techniques for enhancing and/or extracting selected features from an image. Additional courses cover the principles of remote sensing using visible, infrared, and microwave electromagnetic energy. Theo-

retical courses are complemented by practical exercises, courses organized to work on relevant projects, and independent study opportunities.

Unique opportunities are available to integrate photogrammetry, remote sensing and other aspects of mapping science in a coherent fashion. A core of courses in photogrammetry, remote sensing, Geospatial Information Systems, and statistics may be supplemented by many other courses and educational opportunities at ESF and Syracuse University (SU). This flexibility allows programs to be tailored to the interests and strengths of individual students. All students obtain fundamental coverage of geometric and radiometric theory, analysis, interpretation, and applications. Further specialization through many advanced graduate courses or continued general study is then possible. Study programs may also be extended into GIS, either emphasizing spatial data acquisition for GIS databases or focusing on using a GIS database to improve remote sensing analyses.

Facilities are excellent and expanding, with a focus provided by the Mapping Science Laboratory operated by the Faculty of Forest Engineering. Additional computers are available at Syracuse University, including the SU Advanced Graphics Research Lab. Capabilities include full-featured image processing; a full range of optical/mechanical and analytical photogrammetry instruments; extensive equipment for image interpretation; sensor and atmospheric modeling systems; photographic acquisition and processing; many different GIS; and extensive surveying capacity.

Students with engineering, science, or geography backgrounds are particularly suited to this program of study. Program flexibility also allows specialization in any aspect of the above subjects from within other degree programs (e.g., forestry, landscape architecture, wildlife biology, etc.). Numerous opportunities exist for research and financial support. Cooperative and contractual arrangements exist with many agencies, including the U.S. Department of Agriculture, the U.S. Air Force, and NASA. Employment opportunities are exceptional.

Process and Environmental Systems Engineering

Participating Faculty: HASSETT, HOLM, HOLTZMAN, JELINEK, RAMARAO, TOLL, TULLY

- Behavior and control of units and systems
- Reduction of air and water pollution
- Modeling and simulation of papermaking
- Processing of fibrous wastes

Process engineering links research with development, design, operation, and optimization of manufacturing methods and equipment, seeking improvement through technological innovation consistent with environmental and resource stewardship. Principles of engineering science and mathematics are applied to analysis and dynamic modeling of units and systems, with increasing use of computers in both research and professional practice. Research here includes process dynamics and control, studies of new pulping and bleaching processes, characterization and treatment of waste streams, by-product recovery, and computer simulation of paper processing systems. The extensive laboratories and pilot plant in Walters Hall are strongly supported by computing facilities and expertise on campus, including the Center for Computer Applications and Software Engineering (CASE) of Syracuse University. Appropriate advanced courses in engineering, mathematics, and computer science are available to suit individual student interests and needs.

Pulp and Paper Technology

Participating Faculty: BAMBACHT, CÔTÉ, DENCE, HANNA, HOLTZMAN, JELINEK, LAI, LUNER, MARK, UNBEHEND

- Pulping conditions and fiber properties
- Behavior of fiber fines in papermaking
- Statistical analysis of paper structure
- Recycling of papermaking fibers

Studies in this area deal closely with processes involved in the manufacture of pulp and paper. Courses concerned with this subject are central to a student's program, extended and enriched with selected courses in chemistry, polymers, chemical engineering, process control, applied mathematics, and computer applications. Current research projects include studies of pressurized stone grinding of hardwoods, chemithermomechanical pulping, effects of wet pressing and press drying on sheet properties, pulping of tropical woods, and computer simulation and control of papermaking. Supporting this work is an experimental pulp and paper mill with two complete paper machines, a pressurized refiner and extensive auxiliary equipment.

Water Resources Engineering

Participating Faculty: HASSETT, LEE, McCLIMANS, TULLY

- Distributed process hydrologic models
- Parameter estimation
- Real time hydrologic models
- Use of remotely acquired data in hydrologic systems

Studies deal with describing natural and man-made systems for distributing water resources. Emphasis is placed on the engineering and economic reasons for planning and for choosing between alternative solutions to water resource problems within environmental, legal, social and managerial constraints. Analysis techniques using statistics, numerical analysis and computer methodologies are normally included in individual programs. Hydrologic models are being developed as components of geographic information systems.

Wood Science and Technology

Participating Faculty: DAVIDSON, KYANKA, MEYER, RESCH, L. SMITH, W. SMITH

- Adhesives and Finishing
- Drying and Machining
- Composite Materials
- Mechanical and Physical Properties

Wood science and technology includes research on all aspects of wood utilization other than engineering applications. Wood science stresses studies of wood properties important to the use of wood, or to solve problems in wood utilization by practical applications of this knowledge. The program in wood science and technology at ESF began in the early 1920s, when C. C. Forsaith initiated research relating the structure and properties of Northeastern wood species. These studies were soon expanded to include woods from across North America. As additional scientists joined the College, their research interests broadened to include timbers from around the world. The international reputation of the College's wood scientists continues to grow.

Wood Anatomy and Ultrastructure

Participating Faculty: CÔTÉ, HANNA, MEYER

- Wood formation and cell wall organization
- Cytoskeleton of plant cells
- Properties related to anatomy and ultrastructure
- Electron, light and video microscopy

This area requires that the degree can-

didate develop extensive background in all aspects of microscopy: light, scanning electron, transmission electron and video microscopy, including microtechniques for effective preparation of specimens for the appropriate instrument. Wood anatomy studies are basic to wood identification, wood utilization, and physical/mechanical properties. These studies may include woods from other continents, as indicated under the Tropical Timbers study area.

The field of ultrastructure is very broad with applications in many biological, chemical and materials sciences. Applied to wood, it emphasizes the sub-light microscopic structures (smaller than 0.2 micrometers) found in this natural material, either in the mature form or in its formative stages where various organelles of the living cell may be studied for their roles in producing the mature wood cell.

The behavior of wood in its many applications can be observed and explained via microscopy and related instrumentation such as EDXA (energy-dispersive x-ray analysis). State-of-the-art resources and facilities are concentrated in the Center for Ultrastructure Studies, which provides instruction and research support staff.

Tropical Timbers

Participating Faculty: MEYER, DEZEEUW

- Identification keys and systematics
- Wood properties and end use suitability
- Life zone analyses
- Expert systems

Studies in tropical timbers take many forms, depending on individual student interests. Often students from other countries bring specific problems and materials with them, so their thesis will find immediate application when they return home. The library holdings of the Tropical Timber Information Center (TTIC) and reference wood specimens of the H. P. Brown Memorial Wood Collection, both housed in the Faculty of Wood Products Engineering, are vital to this work.

Research topics may be formulated to answer questions dealing with anatomy, identification, properties or uses of various woods from around the world, again using the TTIC or Brown Wood Collection materials. These may be quite narrow such as anatomy and properties of woods from a particular region, or much broader, such as regional distribution of species and species groups based on life zone research throughout a country or other geographic area. An expert system is currently being developed to answer questions about properties and uses of woods from any part of the world. Combining published information on wood with the latest developments in computer software engineering, the knowledge-based system resulting from this study will aid researchers in answering inquiries or in suggesting new pathways for intellectual pursuit.

Wood Treatments

Participating Faculty: L. SMITH, W. SMITH, RESCH

- Wood-water relations and wood drying
- Preservative treatments
- Polymer treatments
- Wood coatings

Graduate study in the field of wood treatments allows the student to investigate the scientific basis for the improvement of wood and wood products with various treatments, which include drying, preservative treatments, and coatings. Preparation research includes graduate coursework in wood-water relationships and transport processes and additional study in areas such as wood anatomy and ultrastructure, mechanical properties, wood chemistry, wood microbiology, thermodynamics, and economics.

Current research interests include use of innovative techniques to dry wood, effect of drying method on the subsequent treatability of wood, evaluation of energy usage of several lumber drying technologies, improving wood properties with polymer treatments, and moisture migration through insulated wall structures.

Modern well-equipped laboratories are available to support these research efforts, including a sawmill, high-temperature, dehumidification, and conventional dry kilns; microprocessor data acquisition and control capability; temperature and humidity controlled environment rooms and chambers; wood permeability laboratory; pressure treating retorts; mechanical strength testing equipment; and light and electron microscopy.

Engineered Wood Products and Structures: Earthquake Engineering

Participating Faculty: HUSSEIN

- Design and construction methods
- Codes and provisions-related issues
- Repair, rehabilitation, and retrofit

Typical subjects of graduate study are: system response to earthquake and wind loads, codified design-related issues, soil-structure interaction, protective systems, and innovative computing and expert systems. Laboratory facilities include dynamic signal analyzer, shaker, accelerometers, linear variable differential transformers, force transducers, hydraulic fatigue testing machine and its intelligent interface, and all required accessories. Shaking tables, computerized data acquisitions, and the MTS are also accessible. State-of-the-art computers and software for finite element analysis (such as NASTRAN, ANSYS, SAPIV, DRAIN2D, TABS), seismic and wind loads on structures, timber shear walls, shear wall-frame interaction, and analysis and design of floor systems are among the available resources. The program includes advanced courses, seminars and workshops, special problems, and interaction with industry.

Engineered Wood Products and Structures: Timber Structures Design

Participating Faculty: DAVIDSON, KYANKA, HUSSEIN, KEULER, SALGADO

- Materials science
- Engineering mechanics
- Computer-aided design

Use of wood and wood-based components in situations where reaction to load, duration of load, and factors of safety are predicted or proscribed by engineering codes and principles. Wooden components as small as dowels or as large as bridge beams are considered, using elements of materials science, engineering mechanics and structural analysis. Basic property knowledge, employing theories of elasticity, viscoelasticity and fracture mechanics, is coupled with computer-aided design data to analyze the performance of wood and to solve application problems, such as those encountered in light-frame construction. How such factors as chemical fire retardant treatments, adhesive performance and mechanical fastener design interact with use requirements is considered. National and international design codes and their development play an important role in specifying research areas of current interest and need. Fabrication and testing of actual components is done in the Wood Products Engineering laboratory facilities.

DIVISION OF FOREST RESOURCES

ROBERT L. BURGESS, *Director*
8 Illick Hall
(315) 470-6741

Dual Undergraduate Program in Environmental and Forest Biology and Resources Management

Environmental and Forest Biology	**Resources Management**
Environmental and Forest Biology with Forestry Electives	Resources Management with Biology Electives

DUAL PROGRAM

This dual curriculum is designed to provide students with a strong background in basic biology and forestry. In doing so it meets the core course requirements in two undergraduate curricula: Environmental and Forest Biology, and Resources Management (Forestry). The Dual Program is one level in a continuum of Biology and Forestry study opportunities at the College.

Dual Program graduates will be highly qualified to work professionally in forested ecosystems. The breadth of training received will prepare them for careers in forestry, forest biology, and other aspects of environmental science in the federal, state, and private sectors. Exposure to diverse courses and extensive field experience enhances their employment opportunities in multidisciplinary programs that are characteristic of contemporary approaches to natural resource management and numerous environmental problems.

The Dual Program requires a *minimum* of five semesters at the upper division level. Six semesters may be necessary for those who lack appropriate lower division courses, or who wish to develop specific professional interests in forest biology or forestry. Students need to be aware of the financial aid implications of one or two additional semesters, especially with respect to the New York State Tuition Assistance Program (TAP), and plan accordingly, starting with the Pre-ESF (lower division) semesters. TAP allows a student eight semesters of payments for an undergraduate degree. Dual students may exceed this number and lose a semester(s) of TAP aid *if* previous payments exceed eight.

A total of 147 credit hours, 62 prior to matriculation, is required. In addition to the 58 credit hours of upper division core courses listed below, six of the elective credit hours must be in Plant Science, six in Animal Science, three in Social Science/Business, six in FOR (Forestry) and three in WPE (Wood Products Engineering) or FEG (Forest Engineering), exclusive of the summer camp experience.

There is less opportunity for free electives in the Dual Program than in the two curricula which it combines. It is rec-

Lower Division Courses

Students entering through the freshman residency program will follow the curriculum described on page 40.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
General Botany and Zoology **OR** General Biology with Laboratory	8
General Chemistry with Laboratory	8
†Organic Chemistry with Laboratory	4
†General Physics with Laboratory	4
†Calculus	3
One additional laboratory course in either chemistry or physics, or a course in calculus or linear algebra	3-4
†Students are strongly encouraged to pursue further coursework in these and related areas in consultation with their advisors.	
English	6
*Social Sciences/Humanities (Sociology **OR** Psychology preferred)	6
*Political Science (U.S. Institutions)	3
*Microeconomics	3
Computer Science	3
Electives	9-10
	60-62

Upper Division Courses

Junior Level			*Credit Hours*
Fall Semester	EFB 320	General Ecology	3
	EFB 336	Dendrology I **OR** Elective	3
	**EFB 352	Elements of Entomology **OR** EFB 303 Introductory Microbiology **OR** EFB 482 Invertebrate Zoology	3-4
	EFB 325	Cell Physiology	3
	Elective		3
			15-16

*Students may be admitted with deficiencies in these subject areas. However, deficiencies must be removed as early as possible in the student's program.

**A spring course, Principles of Forest Entomology—EFB 351, may be substituted if scheduling problems conflict with EFB 352. This will open up 3 hours of electives during the fall semester rather than in the spring.

ommended that elective requirements in plant science and animal science address critical support areas such as forest pathology, plant ecology, and fish and wildlife management, and entomology. Similarly, forestry electives in silviculture, hydrology, or tree improvement are examples of opportunities in important forestry support areas. Students with specific career and professional goals should make them known to their advisor as early as possible so that proper elective course selections can be made. Course selection is made after consultation with each of two advisors; one from the Faculty of Environmental and Forest Biology and one from the Faculty of Forestry.

There is flexibility in the structure of the curriculum that students might wish to investigate. For example, the required Summer Program in Field Forestry, at Warrensburg, may be taken prior to the junior year. This permits highly advantageous courses at the Cranberry Lake Biological Station to be incorporated (see p. 52).

To facilitate transfer at the junior level, it is important that students satisfy the lower division course requirements prior to matriculation at the College of Environmental Science and Forestry.

Students entering at the junior level should have successfully completed a minimum of 62 credits which include:

Upper Division Courses

Junior Year

			Credit Hours
Spring Semester	APM 391	Introduction to Probability and Statistics	3
	EFB 340	Forest and Shade Tree Pathology **OR** EFB 326 Diversity of Plants **OR** Elective	3
	FOR 360	Principles of Management	3
	****Elective		3
	***Social Science/Humanities		3
			15

Summer: FOR 301, 302, 303, 304 Field Forestry Program at Warrensburg 8
Note: If Warrensburg is attended prior to the junior year, 5-10 credits are available at the Cranberry Lake Biological Station.

Fall Semester	FOR 305	Forestry Concepts and Applications	1
	FOR 322	Forest Mensuration	1
	FOR 331	Forest Influences	3
	FOR 332	Silvics	3
	FOR 333	Silvics Laboratory/Practicum	1
	FOR 334	Silviculture	4
	FOR 345	Soils	3
			16

Senior Level

			Credit Hours
Spring Semester	FOR 370	Management of Forest Enterprise	3
	EFB 407	Genetics	3
	EFB 408	Genetics Laboratory	1
	****Electives		9
			16
Fall Semester	APM 492	Biometrics	3
	FOR 400	Forest and Resource Economics	3
	FOR 461	Management Models	3
	****Electives		6
			15

***If this requirement is satisfied in the freshman and sophomore years, biology or forestry electives may be substituted.

****These electives should include at least 3 credits in WPE or FEG, 6 credits in FOR, 3 credits in Social Science/Business, 6 credits in plant sciences (EFB), and 6 credits in animal science (EFB).

THE FACULTY OF CHEMISTRY

ANATOLE SARKO, *Chairman*
228 Baker Laboratory
(315) 470-6855

ANATOLE SARKO, *Chairman* (Physical and Polymer Chemistry), BOYER (Biochemistry), CABASSO (Polymer Chemistry), CALUWE (Organic and Polymer Chemistry), HAMMEL (Biochemistry), HASSETT (Environmental Chemistry), JOHNSON (Environmental Chemistry), KIEBER (Environmental Chemistry), LALONDE (Organic and Natural Products Chemistry), SMID (Physical and Polymer Chemistry), SMITH (Physical and Polymer Chemistry), TANENBAUM (Biochemistry), TIMELL (Wood Chemistry), WEBSTER (Ecological Chemistry), WINTER (Physical and Polymer Chemistry).

The academic program in chemistry enables the student to develop not only an understanding of chemical phenomena, but also an appreciation for chemistry that can link it to the biological and applied sciences. Programs include courses in traditional areas of chemistry, with additional study in fields pertaining to environmental science and forestry. This broad spectrum of academic offerings is possible through close cooperation with Syracuse University, where a wealth of accessory courses at both the undergraduate and graduate levels are available. Emphasis on the investigative function of chemical science is manifest in the wide array of ongoing research projects within the department.

The Faculty of Chemistry offers the following options leading to the Bachelor of Science degree:

Biochemistry and Natural Products Chemistry

Environmental Chemistry

Natural and Synthetic Polymer Chemistry

Each option offers an advanced core of studies beyond the basic courses of the classical undergraduate chemistry curriculum. Additionally, students in all options, by selecting proper electives, may be certified on graduation as having completed an American Chemical Society approved curriculum. All options are excellent grounding for professional work at the B.S. level or for advanced graduate study.

Undergraduate Program

Lower Division Courses

Students entering through the freshman residency program will follow the curriculum described on page 40.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
Biology with Laboratory	8
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory	8
Physics with Laboratory	8
Economics	3
English	6
Language, Literature or Communication	6
Electives	12-15
*Mathematics	6-9
TOTAL MINIMUM LOWER DIVISION CREDITS	68

*Mathematics through integral calculus. An additional mathematics course beyond integral calculus is required for the B.S. degree.

Upper Division Courses

Junior Year			*Credit Hours*
First Semester	FCH 325	Organic Chemistry III	4
	[3]CHE 332	Quantitative Analysis	2
	CHE 333	Quantitative Analysis Laboratory	1
	FCH 360	Physical Chemistry	3
	[1]Professional Elective		2-4
	Elective		3
	FCH 496	Safety and Orientation (required audit)	1
			16-18
Second Semester	[2]Math or Elective		3
	FCH 380	Instrumental Methods	3
	FCH 361	Physical Chemistry	3
	CHE 357	Physical Chemistry Laboratory	2
	FCH 384	Spectrometric Identification of Organic Compounds	2
	[1]Professional Elective		2-3
	Elective		3
			18-19

[1]A two-semester sequence of professional electives to be taken starting in the junior year should be chosen. A student whose option is in *biochemistry* must take 3 semester hours of genetics and an additional 3-semester-hour course in biology (suitable choices are: EFB 303, 320, 351, 352, 387, 448, 505, 524, 530, 532, 533, 540, 560, 570; [3]BIO 316, 418, 445, 446, 516). A student whose option is in *natural products* must take an additional hour of organic chemistry laboratory (FCH 496/18) and a biology course (see the list above). A student in the *environmental chemistry* option can choose from the following courses: APM 391, 500, 510, 620, 625; EFB 303, 320, 421, 451, 452, 512, 524, 525, 560; ENS 505; ERE 440, 441, 420; FEG 340; FOR 345, 364, 446, 520, 540, 543, 550, 587. A student in the *polymer chemistry* option can choose from: APM 391; [3]CHE 366, 511, 545; ERE 362, 420; [3]MAT 331, 398, 511; [3]PHY 322, 531, 544, 581, 582; PSE 300, 301, 370, 371, 372, 465, 466; WPE 326, 361, 386, 387.

[2]One course of mathematics or applied mathematics beyond integral calculus is required. Introduction to Computer Programming, APM 360 (3 credit hours), is suggested.

[3]BIO, CHE, MAT, PHY designations refer to courses offered at Syracuse University.

Biochemistry and Natural Products Chemistry Option

This option is designed for students who wish to approach problems in the life sciences with the tools and point of view of the chemist. In addition to a major concentration in the several branches of chemistry, the student obtains a solid grounding in the fundamentals of physics, mathematics, and molecular biology. Professional electives in botany, ecology, entomology, zoology, or physiology provide the necessary interactions with biologists searching for new solutions to the problems of environment, natural resources, and health.

Upper Division Courses

Senior Year			Credit Hours
First Semester	LIB 300	Library Research	1
	FCH 495	Introduction to Professional Chemistry	1
	FCH 571	Wood Chemistry I	2
	FCH 530	Biochemistry I	3
	FCH 531	Biochemistry Laboratory	2
	Professional Elective/[1]Elective		3
	Elective		3
			15
Second Semester	[2]FCH 498	Introduction to Research	5
	FCH 497	Undergraduate Seminar	1
	FCH 532	Biochemistry II	3
	FCH 573	Wood Chemistry III	2
	Elective		3
	[3]Elective		3
			17
		TOTAL MINIMUM UPPER DIVISION CREDITS	66

[1]Introduction to Polymer Science, FCH 550 (3 credit hours) is suggested.
[2]Petition by student to Department for replacement of this requirement will be considered to allow time for special interest.
[3]Topics in Natural Products Chemistry, FCH 524 (3 credit hours) is suggested.

A total of 134 credit hours is required to complete the B.S. degree in Chemistry with the Biochemistry and Natural Products option.

Environmental Chemistry Option

The environmental chemistry option is designed for those students who wish to obtain a solid fundamental background in chemistry which will enable them to make a strong contribution towards the identification and solution of problems in the areas of pollution, air and water quality, analysis and basic research in environmental chemistry. A large number of professional electives, available through course offerings of other departments such as biology and engineering, provide the important interface with other disciplines necessary for a working understanding of the complex problems inherent in environmental studies.

Senior Year			Credit Hours
First Semester	LIB 300	Library Research	1
	FCH 495	Introduction to Professional Chemistry	1
	FCH 510	Environmental Chemistry I	3
	FCH 515	Methods of Environmental Chemical Analysis	3
	Chemistry Elective		3
	Professional Elective/[1]Elective		3
	Elective		3
			17
Second Semester	[2]FCH 498	Introduction to Research	5
	FCH 511	Environmental Chemistry II	3
	FCH 497	Undergraduate Seminar	1
	FCH 519	Environmental Chemistry Seminar	1
	Electives		6
			16
		TOTAL MINIMUM UPPER DIVISION CREDITS	67

[1]Biochemistry I, FCH 530 (3 credit hours) is suggested.
[2]Petition by student to Department for replacement of this requirement will be considered to allow time for special interest.

A total of 135 credit hours is required to complete the B.S. degree in Chemistry with the Environmental Chemistry option.

Natural and Synthetic Polymer Chemistry Option

This option is designed for students interested in the structure and physical properties of man-made and natural materials, the giant molecules of wood, plastics, polysaccharides, proteins, rubbers, and fibers. The chemistry of these materials constitutes one-half the concern of the chemical industry and is the origin of a major revolution in our way of life and our understanding of nature.

Upper Division Courses

Senior Year			*Credit Hours*
First Semester	LIB 300	Library Research	1
	FCH 495	Introduction to Professional Chemistry	1
	FCH 550	Introduction to Polymer Science I	3
	FCH 551	Polymer Techniques	2
	FCH 571	Wood Chemistry I	2
	Professional Elective/[1]Elective		3
	Elective		3
			15
Second Semester	[2]FCH 498	Introduction to Research	5
	FCH 552	Introduction to Polymer Science II	3
	FCH 497	Undergraduate Seminar	1
	FCH 573	Wood Chemistry III	2
	Electives		6
			17
		TOTAL MINIMUM UPPER DIVISION CREDITS	66

[1]Biochemistry I, FCH 530 (3 credit hours) is suggested.
[2]Petition by the student to Department for replacement of this requirement will be considered to allow time for special interest.

A total of 134 credit hours is required to complete the B.S. degree in Chemistry with the Natural and Synthetic Polymer option.

Graduate Program

Recent years have seen profound advances in the fundamental knowledge of chemical areas that have special significance for forestry and the environment. The following research areas have received active attention by both faculty and graduate students in the programs: polymer chemistry and physics; wood chemistry; environmental chemistry; biochemistry; chemistry of natural products, including ecological chemistry; and materials sciences.

Requirements for a master of science or doctor of philosophy degree in chemistry include a research project and thesis, along with an appropriate program of courses at the College and at Syracuse University.

Specific projects may vary from year to year, since they reflect the current interests of the faculty. Current research projects with *physiochemical* emphasis are: the chemistry, physics, solid-state, and solution properties of natural and synthetic polymers, including studies in thermodynamics, statistical mechanics, crystallization, morphology, elasticity, conformation of macromolecules, optical properties, polymer catalysis, mechanism of polymerizations, polyelectrolytes, ion binding to macromolecules and ion pairing; chemistry of free radicals, radical ions and charge transfer processes; structure and properties of ionic solutions in nonaqueous media; crystal structure and morphology of cell wall constituents; polymer membrane properties and technology; and heavy metal speciation. Current *organic* chemistry programs deal with synthesis of special polymers such as high temperature aromatic block, stereoregular vinyl polymers; various aspects of natural products isolation and synthesis including the characterization of insect and mammalian attractants. In *biochemistry*, faculty members are studying mechanisms of action of plant growth hormones and other biologically active natural products, biochemical regulation of growth and development, and plant and fungal enzymology. Current studies in *environmental chemistry* include behavior of trace organic contaminants in the Great Lakes system, characterization of natural organic compounds in water, identification and characterization of particles in air and water, and development of sensitive sampling and analytical methods for air and water environments.

Graduate research laboratories in the Hugh P. Baker Laboratory are well equipped for polymer studies, chemical, and biochemical research. Instrumentation includes analytical and preparative ultracentrifuges, FTIR and other recording infrared and ultraviolet spectrophotometers, mass spectrometers, differential scanning calorimeters, nuclear magnetic resonance spectrometers, automatic membrane osmometers, solid- and solution-state light scattering photometers, optical rotatory dispersion spectrometer, analytical and preparative high performance liquid chromatographs, combined gas chromatograph-mass spectrometry center, spectrofluorimeter, several scanning and transmission electron microscopes, x-ray diffraction instrumentation, chromatography and cold laboratories, and radiochemical laboratories with counters for solids, liquids, and gases.

THE FACULTY OF ENVIRONMENTAL AND FOREST BIOLOGY

ROBERT L. BURGESS, *Chairman*
8 Illick Hall
(315) 470-6741

Programs in Environmental and Forest Biology provide students with a firm foundation in basic biology, forest ecosystem dynamics, and environmental science. They encompass a variety of interconnected disciplines concerned with living systems, and treat not only the form, function, and evolution of organisms, but their life requirements, tolerances, and interactions that are central to the stewardship of renewable natural resources and the maintenance of environmental quality.

The critical importance modern society places upon the utilization of natural resources and the quality of our environment adds new and increasingly diverse dimensions to the services a well-trained biologist can render. The faculty is committed to meet this dynamically changing array of opportunity through coursework enriched by an active program of research that focuses upon upper-level undergraduate and graduate study. Through the addition of selected electives to a required core, undergraduates may focus their program toward a special biological field (see p. 52) or toward future graduate study. Graduate students may develop a course of study under the guidance of a Major Professor and graduate committee within any of several areas of study (see p. 53).

The academic programs stimulate interest in the recognition and understanding of plants, animals, and protists, and deal with an understanding of the dynamic changes in biological systems in the context of the broad fields of ecology, physiology, genetics, and evolution. This is accomplished by an integration of coursework with a strong research program.

Undergraduate Program

The curriculum for the Bachelor of Science degree is built around a core of required courses which provide the student with a general education, a basic background in the principles of the biological and the physical sciences, and an orientation to forest resources. Its design develops breadth in biology as well as depth in a special biological field. Although individual course selections may vary, all students major in environmental and forest biology and each, with an assigned advisor, develops a special plan of study.

Lower Division Courses

Students entering through the freshman residency program will follow the curriculum described on page 40.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
General Botany and Zoology **OR** General Biology with Laboratory	8
General Chemistry with Laboratory, 2 semesters	8
*Organic Chemistry with Laboratory, 1 semester	4
*Physics with Laboratory, 1 semester	4
*Calculus, 1 semester	3-4
One additional laboratory course in either Chemistry, or Physics, or a course in Calculus, or Linear Algebra, 1 semester	3-4
English	6
**Social Sciences—Humanities	9
Electives (recommended in Biology, if available)	13-15
TOTAL MINIMUM LOWER DIVISION CREDITS	60

*Students are strongly encouraged to pursue further coursework in these and related areas in consultation with their advisors.

**A course in technical writing and/or speech is highly recommended as part of the Social Science—Humanities group.

Upper Division Courses

Junior Year			*Credit Hours*
First Semester	EFB 320	General Ecology	3
	EFB 325	Cell Physiology	3
	Electives		9
			15
Second Semester	APM 391	Introduction to Probability and Statistics	3
	EFB 307	Principles of Genetics	3
	EFB 308	Genetics Laboratory	1
	Electives		8
			15

SUMMER FIELD EXPERIENCE—Must be met as described on page 52 5

Senior Year		*Credit Hours*
First Semester	Electives	15
Second Semester	Electives	15

Electives *must* include one course from each of groups **A**, **B**, and **C**.

A	**B**	**C**
Elements or Principles of Entomology	Dendrology I	Climatology
Invertebrate Zoology	Plant Diversity	Earth Science
Environmental Microbiology	Forest Pathology	Geology
		Meteorology
		Soils

Additionally, students *must* take a minimum of six (6) credit hours each of animal and plant science and this may include courses from lists **A** and **B** not used above.

TOTAL MINIMUM UPPER DIVISION CREDITS 65

A total of 125 credit hours is required to complete the B.S. degree in Environmental and Forest Biology.

A dual-major program is available that meets the undergraduate requirements of Environmental and Forest Biology and of Forestry (see p. 46).

A total of 125 credit hours is required for the Bachelor of Science degree. In addition to the core courses and Summer Field Experience specified below, at least 21 hours in biology at the 300 level or above must be completed. Of these, at least 15 must be from courses in the College of Environmental Science and Forestry. Six of the 21 credit hours must involve subject matter in plant science and six in animal science. The balance of the required hours is chosen in consultation with the advisor.

SUMMER FIELD EXPERIENCE

Cranberry Lake Biological Station

Between the junior and senior year, each student completes a minimum of five semester credit hours (or equivalent) during residence in an approved academic program in field biology. This requirement is usually met by the appropriate selection of courses at Cranberry Lake Biological Station (CLBS) where courses are offered during each of two sessions. Earning five credits at one session satisfies the requirement; any additional courses taken in the other session count as elective credits.

Cranberry Lake and its environs are ideally suited for an advanced biology summer program. The surrounding topography is rolling hill and lake country dotted with numerous small ponds, closed bogs, and stream drainages. The lake is the third largest body of water in the Adirondacks. Because 80 percent of the shoreline is in State ownership, the lake remains unspoiled by recreational developments and pollution problems. Much of the original forest cover in the region was harvested years ago; today a rich variety of community types occupies those sites as the vegetation reverts to natural conditions. The remaining virgin forests also provide students with many examples of stable forests, each type reflecting the particular environmental conditions controlling forest development. A wealth of wildlife parallels the variety of cover types over the region. The area provides easy access to a wide range of additional ecosystems ranging from bog to alpine types.

Facilities include four classroom-laboratories; dining facilities for 120; faculty quarters and cabins; an administration building; 12 cabins housing 6-8 students each; a recreation hall; and several smaller, supporting buildings.

The program extends through June and July, divided into two sessions. Courses are designed to emphasize and effectively utilize the unique nature of this Adirondack setting, and all involve field trips each day into the surrounding forest and aquatic ecosystems.

Information about the Summer Program, including courses and fees, may be obtained from the Director, Cranberry Lake Biological Station, State University of New York College of Environmental Science and Forestry, Syracuse, New York 13210.

Alternatively, other biological field stations may be attended to earn the minimum five semester hours credit (or equivalent). Petitions requesting this alternative must include course descriptions and the program contemplated and be submitted at least one month prior to the end of the spring semester preceding the summer program. A current file of alternative stations and course descriptions is maintained by the director of the Cranberry Lake Biological Station.

Electives and Elective Concentrations

The curriculum meets general requirements for graduate study and for a wide range of federal, state, municipal, and private biology positions. Those training for biological positions in federal and state service should review Civil Service publications and become familiar with specific course requirements early enough to make timely elective choices. Students are urged to use some elective time to enhance their communications skills. Courses in technical writing, applied communications or a language (as approved by their faculty advisor) are especially useful.

Listed below are eight elective concentrations that focus on specialized fields of biology. Further information on these can be found in the *Career Guide* handbook for biologists available from the departmental office.

Ecology. The purpose of the undergraduate elective concentration in ecology is to give students a basic knowledge on the relations of organisms to their environment and how these affect their distribution and abundance. There are four major areas in ecology: Organismal Ecology, Population-Evolutionary Ecology, Community Ecology and Systems Ecology. Undergraduate students choose courses from at least two of these four areas to obtain training beyond that of the general course in ecology. The practical and theoretical application of ecology is emphasized through courses at both ESF and Syracuse University as well as at the Cranberry Lake Biological Field Station. Students in Environmental and Forest Biology are encouraged to select courses from this concentration in a manner compatible with their interests and educational goals. Examples of possible course selections and a listing of ecology courses are given below.

Students in this concentration will have an excellent background to pursue graduate work in ecology. This concentration will serve as a basic foundation for students who have an interest in developing ecological expertise. Preparation in ecology will serve students who pursue further training or employment in those areas of research, teaching, or management which apply ecological principles.

In addition to core biology courses, students in the ecology concentration take one semester in Undergraduate Seminar in Ecology (EFB 492), plus at least one course from two of the following four categories:

I. Organismal Ecology
EFB 445 Plant Ecology
EFB 448 Physiological Ecology of Plants
EFB 480 Principles of Animal Behavior
EFB 505 Microbial Ecology
EFB 554 Aquatic Entomology
BIO 423 Comparative Animal Physiology
BIO 427 Physiological Plant Ecology

II. Population/Evolutionary Ecology
EFB 310 Evolution and Systematic Biology
EFB 409 Introduction to Quantitative and Population Genetics
EFB 515 Population Ecology
BIO 343 Population Biology
BIO 401 Evolution and Population Genetics[1]
BIO 402 Demography and Behavioral Ecology[1]
BIO 410 Seminar in Population Ecology
BIO 431 Population Genetics

III. Community Ecology
EFB 487 Ecology of Adirondack Fishes
EFB 578 Terrestrial Community Ecology
EFB 678 Practicum in Terrestrial Community Ecology
BIO 403 Physiological and Community Ecology[1]

[1]Tutorial

IV. Systems Ecology (Ecosystem, Landscape, Global)
EFB 498 Ecosystems
EFB 518 Systems Ecology
EFB 529 Ecology of the Soil Plant System
EFB 542 Freshwater Wetland Ecosystems
EFB 610 Ecological Energetics and Nutrient Cycling

Entomology. Insects play significant roles, both beneficial and detrimental, in their interactions with man, natural resources, and environment. Courses enable a student to fulfill requirements of Civil Service and a variety of other employers. Program strengths are in forest entomology, medical entomology, pest management, and environmental toxicology.

Environmental Microbiology. Microbiology is a dynamic and exciting science that deals with bacteria, molds, algae, yeasts, protozoa, rickettsiae, and viruses: their roles in industry, disease, the environment, and everyday life. Careers in microbiology are available throughout the public and private sectors, and related to many different professions and industries.

Fish and Wildlife Biology and Management. A basic and applied program in fish and wildlife biology, including management and behavior, is provided for students whose objectives are to develop professional skills in the biology and management of these natural resources. This program offers a broad education in the biological sciences with a strong foundation in ecology. Course selections are readily tailored to meet certification requirements for The Wildlife Society and the American Fisheries Society. Specialized and advanced courses are offered in fishery biology, wetland ecology, wildlife ecology and management, limnology, habitat analysis, and wildlife techniques.

Pest Management. Modern control of insects and disease dictates practices appropriate to maintaining an acceptable environmental quality. Through proper course selection, students are able to achieve training in wise selections of methods for an integrated approach to pest management. Training thoroughly prepares students for state examinations required for pesticide applicator's certification.

Plant Physiology. Plant physiology, part of the broader science of botany, concerns the life processes that occur in plants. Career opportunities are available in federal, state, and local governments through their extensive testing and monitoring programs. Additionally, positions are available in agriculture and forestry concerning pathogenic microorganisms and physiological mechanisms of infection.

Plant Science. Students may prepare for a wide variety of opportunities in the botanical professions. Essential to understanding plants are their biochemical and physiological processes; their interactions with the environment and with one another; with animals and other organisms; their genetic makeup, evolution and classification. Requirements may be satisfied for technical positions in areas such as botany, plant ecology, tree genetics, plant physiology, horticulture, tree maintenance, or plant quarantine.

Zoology. A broad program is provided for the student whose objectives are to go on for graduate study or to further training in physiology, soil invertebrate ecology, animal behavior, or animal ecology. Some opportunities with federal and state agencies are available at the baccalaureate level.

Internship Program

A variety of internships are available, either in the summer or one semester of the academic year. These are arranged in cooperation with the student's advisor. Agencies actively involved with the internship program include the U.S. Fish and Wildlife Service, New York State Department of Environmental Conservation, and the National Park Service.

Accelerated Five-Year BS/MS Track In Plant Biotechnology

Biotechnology, the use of biological techniques and processes to provide for the well-being of mankind, has arisen with the recent expansion of our understanding of cell biology that permits the manipulation of molecules involved in reproduction and specific biological systems. We now have the ability to design better biological agents and organisms for human benefit. The undergraduate component of this integrated course of study prepares students not only for graduate work in plant biotechnology, but also for career opportunities available at the baccalaureate level.

The undergraduate track includes all requirements for the Bachelor of Science degree in Environmental and Forest Biology. In addition, courses in plant science, chemistry and biochemistry, and introductory courses in genetic engineering and tissue culture technology are required.

The five-year accelerated Bachelor of Science/Master of Science track in Plant Biotechnology is a new endeavor within the graduate program in Environmental and Forest Biology. Admission to the M.S. degree is open to all students with strong backgrounds in biology and chemistry. Students completing the undergraduate component at ESF must satisfy the normal graduate admission requirements of the College.

The accelerated M.S. program requires a minimum of one year plus two summers of full-time study. Students will usually undertake the "Project-Thesis Defense" program alternative. Course requirements include plant recombinant DNA technology, genetic engineering and biotechnology; plant virology; seminars and laboratory techniques. Graduates will be well-prepared for professional careers as highly trained technical specialists, in research associated with industrial and governmental laboratories, or for continuing graduate study in a Ph.D. program.

Graduate Program

The graduate program in Environmental and Forest Biology is organized in eight interdependent areas of study that provide comprehensive coverage within specific interest areas. Faculty in each area define the scope of subject matter, recommend acceptance of students and guide them in a course of study. It is opportune for students to develop a degree of specialization in at least one large taxonomic group (e.g., fungi, plants, vertebrates, insects) to assure a useful mix of talents.

Most students seeking the M.S. degree include a research thesis and its defense (see p. 29). There also is a program alternative to earn the degree with 42 hours of coursework specified by the student's advising faculty. All who seek the Ph.D. must include original research and a dissertation or its equivalent in the form of refereed publications.

The center of activity is Illick Hall, with laboratories, classrooms, controlled spaces, and equipment in a modern building in which 8,000 square meters of working space is available for graduate study and research. Laboratories, many of them temperature and temperature-humidity controlled, and one sound-controlled, are

provided for study and research in plant development, physiology, tissue culture, molecular biology, biochemistry and toxicology, ecology, and animal behavior. An herbarium, mycological collections, insect and other arthropod collections, and the Roosevelt Wildlife Collection of vertebrates are maintained as resources for the academic program. Eight rooftop glasshouse units, three of them air-conditioned and one incorporated into a five-room indoor-outdoor insectary, are important to the full array of interests in plant science and plant-animal interactions.

Also available to students and faculty is a variety of sophisticated instrumentation: convenient access to a computer center; radioisotope counting equipment, including liquid scintillation spectrometer and Cobalt-60 source; diverse analytical equipment and measuring devices; gas-liquid chromatography; and a comprehensive analytical expertise. The N. C. Brown Center for Ultrastructure offers coursework and research in scanning and transmission electron microscopy.

Supportive to the program are the academic resources, including courses, of Syracuse University, SUNY's Health Science Center and the several campus facilities described elsewhere in this catalog. Our students also participate in courses and utilize faculty and facilities at Cornell University and several SUNY campuses in cooperative exchanges.

Excellent field sites and facilities are available for research in all aspects of the program in nearby or moderately distant locations. In addition to the College's several campuses and field stations that offer a broad diversity of forest types, sites, and conditions, there are New York State Department of Environmental Conservation lands, the Montezuma National Wildlife Refuge, the Adirondack Mountains, and the transition zones near Lake Ontario, Oneida Lake, and Cicero Swamp. These areas offer a variety of habitat diversity from highlands to aquatic-terrestrial zones. The ponds, streams, and lakes in Central New York and the St. Lawrence River are regularly used by graduate students in aquatic ecology, fishery biology, and ecosystem science.

Further academic advantages stem from the urban setting of the Syracuse campus. Nearby Onondaga Lake is a prominent feature that serves as a focus of many research and teaching activities. The Greater Syracuse area provides a convenient laboratory for studies basic to urban ecology: the growth and protection of woody vegetation, greenspace maintenance, the utilization of waste beds for plant growth, the detoxification of pollutants, and the restoration of terrain stripped of vegetation. Disposal of industrial and human wastes requires deeper understanding of the role of plants, animals and microorganisms in the biodegradation of organic matter. The conversion of organic materials into useful fuel, into additives for plant growth, or into protein feeds for domestic animals are stimulating study-in-depth of many elements of basic biology offering substantial assistance toward the solution of pressing human problems.

Eight areas of study are available: *Ecology, Entomology, Environmental Physiology, Fish and Wildlife Biology and Management, Pathology and Mycology, Plant Science and Biotechnology*, and *Soil Ecology*. One, *Chemical Ecology*, is shared with the Faculty of Chemistry. Additional information on each of these areas of study is available by telephone or written request to any of the professors listed.

AREAS OF STUDY

Ecology

ALEXANDER (Vertebrates, Wetlands), ALLEN (Forest Insects), BALDASSARRE (Wetlands), BROCKE (Wildlife, Bioenergetics), BURGESS (Forest Ecology), CHAMBERS (Wildlife), DINDAL (Invertebrates, Soil Ecology), HALL (Systems Ecology), KURCZEWSKI (Insect Behavior), LEOPOLD (Dendrology, Community Ecology), MITCHELL (Biogeochemistry), MÜLLER-SCHWARZ (Vertebrates Behavior), NAKAS (Microbiology), NORTON (Soil Ecology), PORTER (Vertebrate Ecology), RAYNAL (Physiological Ecology, Demography), RINGLER (Aquatic Ecology, Fish Behavior), SCHAEDLE (Plant Nutrition), SHIELDS (Vertebrate Behavior), SIMEONE (Forest and Wood-boring Insects), STEWART (Aquatic Ecology), TURNER (Vertebrate Physiological Ecology), VANDRUFF (Wildlife), WERNER (Limnology).

Adjunct Faculty

MCDOWELL (Aquatic Ecology), MONHEIMER (Fish and Wildlife Ecology), CHEPKO-SADE (Primate Ecology), WALI (Forest Ecology).

This integrative study area allows students to investigate the relationships of organisms to their environment and those factors which affect their distribution and abundance. Both the practical and theoretical application of ecology is emphasized through courses and research. There are four major areas in ecology: Organismal Ecology, Population-Evolutionary Ecology, Community Ecology, and Systems Ecology. In consultation with the student's steering committee, courses are chosen from these areas, as well as other disciplines. Specific research may encompass any of the four major areas of ecology and entail the study of the distribution and abundance of organisms, community structure including trophic relationships, diversity or succession, and ecosystem properties, such as patterns of energy transfer and biogeochemical cycling.

Entomology

ABRAHAMSON (Forest Insects, Pest Management), ALLEN (Forest Insects, Population Ecology), BREZNER (Physiology), CASTELLO (Virology, Insect Vectors), KURCZEWSKI (Morphology, Taxonomy, Behavior), MILLER (Pest Management), MITCHELL (Population Ecology), NAKATSUGAWA (Toxicology), NORTON (Soil Arthropods, Systematics), Insect Larval Taxonomy), RINGLER (Aquatic Entomology), SIMEONE (Forest and Wood-inhabiting Insects).

Adjunct Faculty

CAMPBELL (Forest Entomology), HOWARD (Medical Entomology).

Graduate study opportunities prepare students in the basic aspects of insect life and the role of insects in relation to man and his environment. The wide range of effects stemming from insect activity, from the beneficial to the deleterious, allows for a variety of research subjects in which insects play a major role. Thesis topics may concern insects that affect forests, shade trees and wood products, those relating to the health and well-being of man and those playing key roles as parasites and predators of pest species. Current research areas include population dynamics of forest defoliators, pheromone communications among beetles and moths, speciation of insects as understood through behavioral and cytogenetic study effects of larvicides and fish predators on stream benthic insects, natural control of insects in forest systems and basic biochemistry of insect detoxification mechanisms.

Environmental Physiology

BREZNER (Insect Physiology), CASTELLO (Plant Virology), GRIFFIN (Fungus Physiology), MITCHELL (Environmental Energetics), NAKAS (Microbial Physiology), NAKATSUGAWA (Insect and Vertebrate Toxicology), SCHAEDLE (Plant Physiology), WALTON (Plant Physiology), WILCOX (Plant Physiology).

Adjunct Faculty

WALI (Physiological Ecology).

The Environmental Physiology area of study provides students with advanced training in the nature and control of biological processes. Current interests include

mechanisms of action of plant growth hormones; biochemical regulation of seed germination; plant and microbial enzymology; virology; toxicity and disposition of insecticides and environmental toxicants in vertebrates; production and action of plant phytoalexins and antibiotics; plant defenses against phytophagous invertebrates; mycorrhizae, ion transport; mineral nutrition, cambial physiology and photosynthesis.

Fish and Wildlife Biology and Management

ALEXANDER (Vertebrates, Herpetology), BALDASSARRE (Waterfowl), BROCKE (Vertebrates), CHAMBERS (Vertebrates), MÜLLER-SCHWARZE (Vertebrate Behavior), PAYNE (Ornithology), PORTER (Vertebrate Ecology), RINGLER (Fisheries, Aquatic Ecology), SHIELDS (Vertebrate Behavior), STEWART (Fisheries, Aquatic Ecology), TURNER (Vertebrate Physiology), VANDRUFF (Vertebrates, Ornithology), WERNER (Limnology, Fisheries).

Adjunct Faculty

BRANDT (Fisheries Science), BROWN (Wildlife Ecology), CHEPKO-SADE (Primate Behavior), MCDOWELL (Fisheries), MONHEIMER (Wildlife Ecology), SCHACHTE (Aquaculture, Pathology).

Study in this area provides students with advanced preparation in biological concepts of fish and wildlife populations as they relate to proper management. Increasing concern for these wild animal resources has been matched by strong student interest in educational programs which prepare them for careers in the fish and wildlife professions. Graduate education is rapidly becoming a universal prerequisite to employment as a professional fisheries or wildlife biologist.

Areas of research include population-habitat relationships, predator ecology, fish behavior, wildlife in Adirondack ecosystems, urban wildlife relationships, endangered species studies, feeding ecology of fishes, stream ecology, Great Lakes fisheries, ecology of larval fishes and homing behavior of fishes.

Forest Pathology and Mycology

ABRAHAMSON (Forest Pathology, Entomology), CASTELLO (Forest Pathology), GRIFFIN (Fungus Physiology), MANION (Forest Pathology), NAKAS (Microbiology), POWELL (Plant Pathology and Molecular Biology), ROGERS (Plant and Molecular Biology), VALENTINE (Genetics), WANG (Mycology), WILCOX (Mycorrhizae), WORRALL (Forest Pathology).

Adjunct Faculty

HAMMILL (Mycology)

Forest Pathology and Mycology trains students to develop an expertise responsive to the increasing pressures on forest and shade tree systems for wood fiber, public services, and amenities. This requires new sophisticated levels of disease understanding, disease control, a broad knowledge of fungi, bacteria and viruses, their environmental impacts and their roles in biodeterioration. Areas of interest include: environmental, fungal and viral tree diseases; mycorrhizae; wood decay and biodegradation processes; monitoring and impact assessment of disease in forest and urban tree systems; chemical and biological control of tree diseases; epidemiology of tree diseases and the genetics of resistance to tree diseases and to pathogen variability; physiology of fungus growth and development; taxonomy and biology of decay and imperfect fungi; and fungus ultrastructure.

Plant Science and Biotechnology

BURGESS (Ecology), CASTELLO (Virology), GRIFFIN (Mycology, Fungus Physiology), LEOPOLD (Dendrology, Community Ecology), LOWE (Mycology), MANION (Pathology), NAKAS (Microbiology), POWELL (Plant Pathology and Molecular Biology), RAYNAL (Ecology, Taxonomy), ROGERS (Plant and Molecular Biology), SCHAEDLE (Physiology), SILVERBORG (Pathology), TEPPER (Anatomy, Morphogenesis), VALENTINE (Genetics), WALTON (Physiology), WANG (Mycology), WILCOX (Physiology, Mycorrhizae), WORRALL (Pathology).

Adjunct Faculty

GOULD (Environmental Microbiology), MILLER (Physiology).

Plants, as the base for ecological food chains, serve as the structural and functional foundation of natural and managed systems. The Plant Science and Biotechnology Concentration provides opportunity for study in a broad range of specialties fundamental to the understanding of plants and their interaction with other organisms and for specializing in plant biotechnology. Emphasis is on forest and related plant systems. Current research interests include: dynamics of plant communities as affected by man and the environment; mechanisms of plant succession; epidemiology of forest and urban tree diseases; decay, discoloration and biomodification of wood; taxonomy, physiology, growth and ultrastructure of fungi; heritability of wood properties and disease resistance of trees; biochemistry and physiology of plant growth regulators; photosynthesis; mineral nutrition; mycorrhizae; morphogenesis in shoot and root systems; and plant tissue culture.

Soil Ecology

DINDAL (Invertebrates), MITCHELL (Invertebrates, Energetics), NAKAS (Microbiology), WANG (Mycology)

Adjunct Faculty

WALI (Nutrient Dynamics).

Soil ecology includes the study of interrelationships of soil-inhabiting organisms (as individuals, populations and communities) with their biotic, chemical, and physical environments. This field is a frontier of science because of the myriad of undescribed species of soil-dwelling arthropods, nematodes and annelids, and the wealth of incompletely understood symbiotic relationships. Soil ecology deals with fundamental aspects of biodegradation and nutrient cycling, important for improvements in crop culture and enlightened waste disposal.

The soil ecology concentration is supported by courses in physical aspects of soils, plant and animal taxonomy and general ecology.

Chemical Ecology

MÜLLER-SCHWARZE (Vertebrate Pheromones), SILVERSTEIN (Pheromone Chemistry), SIMEONE (Insect Pheromones), TANENBAUM (Microbial Chemistry).

The area of study in chemical ecology is offered by collaboration between Environmental and Forest Biology and Chemistry. Interested students should apply to the Faculty of major interest, which will have prime responsibility for setting requirements. Faculty from both departments can aid in the development of a plan of study enabling a student to acquire sophisticated skills in either chemistry or biology and an ample understanding of the other to grapple with problems requiring an understanding of both.

As a relatively new interdisciplinary endeavor, workers in this field attempt to understand organismal interactions, both intra- and interspecific, mediated by chemical substances such as hormones, pheromones, kairomones and phytoalexins. These occur at all taxonomic levels: between uni- and multicellular organisms, microbes and plants, plants and plants, plants and animals, microbes and animals, animals and animals. Study of such interactions has been accelerated in recent years through joint efforts of biologists and chemists in meaningful research accompanied by a growing body of literature.

THE FACULTY OF ENVIRONMENTAL STUDIES

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The Faculty of Environmental Studies hosts two degree programs, the Bachelor of Science in Environmental Studies (ES) and the Graduate Program in Environmental Science (GPES), which awards both M.S. and Ph.D. degrees.

GPES and the ES program address environmental issues of high public concern and rest upon the scientific and professional expertise of the College faculty. These programs provide for the study of environmental systems and the interrelationships of human and natural systems. Both are guided by a concern for finding and promoting wise public policies for natural resource and environmental issues. Each program provides a set of core or foundation courses dealing with understanding and analyzing complex environmental systems in their human context, and a range of student choice in choosing interdisciplinary subjects for concentration. Faculty offering instruction and advisement for these programs are drawn from the academic units of the College, and work with students to shape their programs of study to blend student interests with program goals.

BACHELOR OF SCIENCE IN ENVIRONMENTAL STUDIES

The Bachelor of Science in Environmental Studies (ES) program is concerned with the interrelationships among the natural environment, natural resources, and human society, including society's institutions. The goal of the program is to educate students to be sensitive, articulate, and knowledgeable about complex environmental issues facing contemporary society. To achieve this, the ES program promotes (a) sound preparation in technical and scientific subjects and skills, (b) grounding in an environmental area of study, and (c) a synthetic or holistic viewpoint and understanding of environmental concerns.

The B.S. degree is granted at the end of four years and requires the successful completion of 124 credit hours of coursework. The program provides for a pyramidal sequence of study. At the lower division, students acquire a basic knowledge in the natural and social sciences, receive exposure to the humanities, and learn useful communications and analytic skills. Students then enter the ES program as juniors with 60 lower division credits. At the upper division, the student is provided a balanced foundation knowledge of natural and social processes as they relate to the environment, an additional set of useful skills and methods, and a progressive integration of this knowledge through an environmental area of study, leading to a synthesis of learning in the senior year.

The scope and complexity of coursework within the ES program demands both discipline and commitment from students seeking this degree. A clear sense of purpose and objectives are necessary to pursue the curriculum beneficially. To meet each student's objectives fully, a close working relationship between faculty and the student is also necessary. A general orientation for upper division study is provided in the program's four study areas, one of which is chosen by the student during the admissions process before undertaking upper division study. These study areas are: (a) Information and Technology, (b) Land Use Planning, (c) Biological Science Applications, and (d) Policy and Management. Within these general areas of study, students are provided flexibility to further pursue their environmental interests.

Students receiving the B.S. degree have pursued graduate study and careers in the fields of planning, landscape architecture, natural resource management, and other environmentally related areas such as business, education, and law.

Lower Division Coursework[1]

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
A. Natural Sciences	15-20
Coursework must include:[2] General Biology (6-8) (or General Botany and General Zoology), General Geology/Earth Science ((3-4), General Chemistry or General Physics[3] (6-8).	
B. Social Sciences	18
Coursework must include: Economics (3), Government/Political Science (3), Sociology/Cultural Anthropology (3), History (United States) (3), additional coursework, including Psychology, Human Geography, or courses in above subjects (6).	
C. Humanities	6
Courses in Literature, Philosophy, Foreign Language, Art, Music, Drama and related subjects.	
D. Written Communications[4]	6
E. Mathematics and Computer Applications	6
Coursework must include: College-level Trigonometry, Pre-Calculus, or Calculus (3), Computer Applications (3).	
F. Additional Coursework[5]	4-9
TOTAL MINIMUM LOWER DIVISION CREDITS	60

[1] Prior to acceptance into the program, the student must have completed at least 54 of the 60 required lower division credit hours.

[2] At least two courses with labs are required.

[3] Two courses in General Chemistry or General Physics, or one course in each will satisfy this requirement.

[4] Courses aimed primarily at improving writing skills are intended; these generally do not include literature courses.

[5] Depending on student interests, an additional course in American Government or in either General Chemistry or General Physics, whichever has not been taken to meet the Natural Sciences requirements, is recommended.

Prerequisites for Entry into the Environmental Studies Program

Because of the wide range of opportunities available to students who enter the ES program, it is important that they prepare themselves with a broad range of lower division coursework. The accompanying table of lower division requirements summarizes preparation for entering the ES program. The various requirements provide a sound basis for successful engagement of the Environmental Studies curriculum at the upper division, for any of the four program study areas.

Prospective ES students are strongly advised to review ES program literature describing the four study areas, so that their study area selection is made on an informed basis. The role of the study area within each student's program is summarized in the accompanying table of upper division requirements, and each of the study areas provides a distinctive orientation to environmental study, as follows:

Information and Technology is designed for students interested in learning about sources of environmental information, and about measurement and technologies applied to the solution of environmental problems. Work in this study area is supported primarily by the Faculty of Forest Engineering.

Land Use Planning is concerned with the orderly, efficient, equitable, and aesthetic development of land with special concern for the state of the natural environment and the development, interpretation, and administration of land use plans and regulations. This study area is supported mainly by the Faculty of Landscape Architecture.

Biological Science Applications is designed for students interested in environmental careers requiring a solid understanding of biological sciences pertinent to our natural resources, providing additional social science background for applying biological knowledge to problems of societal importance. Work in this area is supported principally by the Faculty of Environmental and Forest Biology.

Policy and Management is concerned with the basic principles, values, and techniques of natural resources and environmental management, including an understanding of the public policies and programs that underscore these concerns. The need to integrate diverse social, institutional, political, legal, and biophysical considerations inherent in attaining environmental objectives is emphasized. This study

Upper Division Courses

	Credit Hours
A. *FOUNDATIONS OF ENVIRONMENTAL STUDIES* .... Coursework is intended to provide a balanced exposure to the range of natural and human aspects of environmental study. The Foundation includes 12-13 credit hours of Natural Science, including FOR 345 Soils, FOR 341 Hydrology and Water Quality, EFB 320 General Ecology, and one course from the following selection: EFB 303 Introduction to Environmental Microbiology, EFB 326 Diversity of Plants, or EFB 483 Biology of Birds and Mammals. The Foundation also includes 9 credit hours of Social Science coursework, including EST 496 (Section) Attitudes, Values, and Environment, EST 321 Government and Environment, and EST 496 (Section) Economy, Society, and Environment, or acceptable alternatives to these Social Science courses.	21-22
B. *SKILLS AND METHODS* .... Coursework is intended to provide grounding in Technical Communications and Technical Methods. The Technical Communications requirement is for 4 credit hours and includes CMN 410 Writing for Professionals, and LIB 300 Library Research. Technical Skills and Methods require 9 credit hours including 3 credits of Statistics, 3 credits of Other Methods, including CMN 531 Environmental Communications, FOR 550 Environmental Impact: Principles and Strategies, APM 360 Introduction to Computer Programming, or an acceptable alternative, and 3 credits of a Special Method which is described for the student's area of study.	13
C. *AREAS OF STUDY* .... Coursework selections for an area of study provide focus for the student's Environmental Studies program, and commence in the junior year of study. Study areas are: Information and Technology, Land Use Planning, Biological Science Applications, and Policy and Management. A 12 credit hour core of study is provided for each. For Information and Technology, the core is: EST 496 (Section) Environmental Measurements, EST 496 (Section) Environmental Technology I, EST 496 (Section) Environmental Technology II, and EST 496 (Section) Introduction to Geographic Information Systems. For Land Use Planning, the core is: EIN 311 Natural Processes in Planning and Design, EIN 451 Community Land Use Planning, EIN 496 Land Use Development Process, and LPP 456 Land Development Law. Core courses for the Biological Science Applications Area of Study include 6 credits of biological resource courses, from which will be selected 3 credits of Plant Resources and 3 credits of Animal Resources coursework. Further coursework of 6 credit hours is selected from an extensive list of biological science course alternatives. For Policy and Management, the core is: FOR 307 Environmental Economics, FOR 360 Principles of Management, FOR 496 Environmental and Resources Policy, and FOR 587 Environmental Law.	12
D. *ADDITIONAL COURSES* .... This coursework provides students with an opportunity for additional educational breadth and depth in Environmental Studies. In this category, students complete 9 credit hours of additional study area courses on topics that lie within the scope for the chosen study area. A list of specific options is provided except in the Biological Science Applications Study Area, in which students are required to complete one course in each of the other three areas of study. An additional 6 credit hours are designated as Free Electives.	15
E. *SENIOR SYNTHESIS* .... Students are required to complete 3 credit hours of coursework during their senior year that synthesizes their Environmental Studies education. This is accomplished through appropriate course selection following the advice of the academic advisor, and may at times be in the form of a small group seminar or internship.	3
TOTAL MINIMUM UPPER DIVISION CREDITS	64-65

A total of 124-125 credit hours is required to complete the Environmental Studies curriculum. Normally up to 60 credit hours taken prior to matriculation at the College of Environmental Science and Forestry will be accepted as advanced standing credits. A minimum of 51 upper division credit hours must be completed to be considered for graduation.

area is supported mainly by the Faculty of Forestry.

Students seeking admission into the ES program should note particularly that identification of choice of study area is required as a condition of final acceptance into the program. This allows students to begin study area coursework in the first semester of the junior year.

GRADUATE PROGRAM IN ENVIRONMENTAL SCIENCE

The collegewide Graduate Program in Environmental Science (GPES) offers M.S. and Ph.D. degrees in environmental science through an interdisciplinary program which draws upon faculty from across the College as well as selected faculty participants from Syracuse University.

The mission of GPES is to provide interdisciplinary education, research, and public service to foster the wise use of natural resources and to prepare students to comprehensively address environmental concerns and problems. Graduates are expected to perform as effective environmental professionals through the use of:

(a) *multidisciplinary approach*—recognition of the necessity to approach environmental problems with input from several disciplines and professions;

(b) *holistic perspective*—awareness of and deference to the interdependence of elements within broadly defined ecosystems, including physical, biological, social, and economic systems;

(c) *topical grounding*—competency to understand and apply the principles of a particular subject of environmental inquiry in sufficient depth to interact with other disciplines and professional fields;

(d) *realistic experience*—through internships, focused projects, theses and seminars which provide for direct interaction of legal, economic, political, and social systems which underlie decisionmaking.

PROGRAM OF STUDY

The Core

Students in the master's degree program complete core requirements in environmental institutions, land information systems, policy analysis, and environmental systems as preparation for work within areas of study. This core of studies provides an understanding of policy, planning, regulation, and analysis. This, coupled with the technical studies provided through the areas of study, constitutes the program framework of effective environmental management.

Program Framework

Environmental management, which is the program framework of GPES, is the utilization of available social and technical resources to protect the natural resource base and to meet the needs of society. An expanded definition may better show the broad sweep of environmental management.

Environmental management is the act of organizing, utilizing, and directing technical, social, human, and economic resources to protect the natural resource base of land, air, water, soil, minerals, plants, and animals; and to meet the needs of society for food, shelter, clothing, pure water, plentiful water, clean air, energy, economic opportunity, economic development, cultural preservation, aesthetic experiences, protection of the public health, wild and scenic areas, waste disposal (solid, liquid and gaseous), recreational opportunities, and protection against natural disasters, to name some of the most obvious needs.

Environmental management activities range from scientific research, to engineering design, to assessing environmental impacts, to facilities construction and operation, to maintain the environment, to public education, to program development, to drafting bills, to developing regulations, to program administration, to redesigning industrial processes, to establishing policy through legislation, to environmental modeling and a myriad of other tasks and activities.

Central to effective environmental management is the study of public policy, how it is formulated and implemented. Policy formulated on the basis of contemporary scientific knowledge together with the societal, economic, and cultural values, pave the way for effective environmental management through the application of engineering and science; and, policy planning, regulation, and program administration.

Through the study of public policy, students gain an understanding of the causes and consequences of policy decisions which will help integrate environmental knowledge with the scholarship of public administration and political science. This integration is necessary because the careers of graduates will either be directly in the public sector, or closely linked with government agencies. Second, an understanding of the causes and consequences of public policy assists students to solve practical problems. Such understanding is valuable in developing strategies and tactics to accomplish desired objectives. Third, the knowledge of public policy causes and consequences creates political awareness, a virtual necessity for any professional irrespective of the sector of employment.

Starting with students who have an undergraduate background in an established discipline or profession (e.g., chemistry, biology, engineering, ecology, forestry), the program seeks to build upon existing strengths while broadening the student's ability to deal effectively with the complex, interdisciplinary problems which arise in environmental studies.

Areas of Study

Within the framework of effective environmental management encompassing both technical and social areas, there are broad areas of study in land resources, water resources, and study in environmental communications. Other interests may be developed on an individual basis through the use of elective courses. These areas of study are designed to be broad based. They are not mutually exclusive and integrate into each other to form a continuum.

LAND RESOURCES

The Land Resources Concentration develops an understanding of present and future trends and issues, patterns of land use, and studies future availability of land for multiple uses. It provides opportunity for economic, sociological, political, policy, planning, and ecological foci. It brings together an interdisciplinary mix of coursework, internship experience or research to address land use value conflict situations, ecologically-based land use considerations of carrying capacity, and appropriate means to anticipate and plan for existing and new land development technologies and processes.

Recommended areas of study include, from (1) physical sciences: energy exchange, soils, remote sensing, visual landscape analysis, meteorology, and soil and water conservation; (2) biological sciences: terrestrial community ecology, wildlife management, and silviculture; (3) social sciences: land use economics, environmental impact, transportation systems, environmental law, and environmental communications.

WATER RESOURCES

The Water Resources Concentration develops an understanding of both the technical information and interdisciplinary relationships of various *water-related* issues. Individual programs may emphasize scientific or social subject areas but *all* students acquire preparation in both areas. Scientific aspects include the basic physical, chemical, and biological interactions occurring in aquatic ecosystems under natural conditions, as well as under modified conditions that result from changes in water quality or quantity. The social aspects are concerned with planning, regulation, law and institutions, and management of water resources. Both as a resource for many human benefits and uses, and as a critical environmental element, water serves as a focus for graduate study in pollution and water quality control, and water and related land resources management.

Recommended areas of study include, from (1) physical sciences: civil engineering, geology, geomorphology, hydrology, meteorology, sanitary engineering, soils, and water chemistry; (2) biological sciences: ecology, entomology, fishery biology, forestry, microbiology, water quality, wildlife management, and zoology; (3) social sciences: administration, economics, government, history, law, and policy.

ENVIRONMENTAL COMMUNICATION

The Environmental Communications Concentration addresses the question: How do we get the environmental message across to the different publics involved?

This involves environmental education, use of mass media, development of those skills necessary to frame and deliver the message, and identifying the publics and getting them involved in the communications process.

Effective communication is a necessary element for fulfilling the social contact in democratic societies. A growing concern in the U.S. public for environmental quality reveals a new interest in the historic, cultural, and natural values associated with our environment. Education provides a continuum of environmental knowledge from awareness and appreciation to scientific concept understanding.

More interactive roles in decisionmaking must emphasize the skills and techniques of public participation. Tasks usually start with soliciting public comprehensions and opinions concerning specific environmental issues, and then employing information dissemination and public interaction. Skills and knowledge in social psychology, public relations, message design and presentation, law and government must be applied.

Recommended areas of study include, from (1) physical sciences: environmental and organic chemistry, environmental geology, mineral resources, energy systems, and soil and water management and conservation; (2) biological sciences: ecology, entomology, and taxonomy; and (3) social sciences: planning, policy, information systems, and instructional technology, journalism, and law.

REQUIREMENTS

The academic requirements of the Graduate Program in Environmental Science are designed to provide graduates with a sound preparation to meet the challenges of the field as leading scholars and professionals. General programmatic requirements constitute a framework to ensure that the individual study program will result in (1) a solid core of knowledge requisite for understanding modern theories, issues, and analytic methods, (2) extended knowledge from study within a selected program option, and (3) experience in the synthesis of environmental concerns.

Each student must be adequately prepared for work in the program. The following undergraduate courses are pre- or corequisite for undertaking the program's core courses: statistics, ecology, and economics (preferably micro-). Students are strongly encouraged to complete these courses before entry into the program, or otherwise they must be completed after matriculation into the program. Where deficiencies in this preparation are found at the time of application, the admission may be made on a provisional basis pending the successful completion of these requirements.

Master of Science

The program is structured as a set of core, areas of study, and synthesis requirements:

1. Core: a total of 15 credit hours is required, as follows:
   ENS 611 Environmental Institutions
   ENS 612 Environmental Information Systems
   ENS 621 Environmental Policy Analysis
   ENS 622 Modeling Environmental Systems
   ENS 796/797 Environmental Policy/Science Seminar
2. Area of study: A minimum of 15 credit hours (excluding 898 and 899 numbered courses) in an area of study, the specific courses for which are determined jointly by the student and Major Professor, consistent with the above descriptions.
3. Synthesis: The student may choose from among three alternatives:
   (a) Thesis or Project: a minimum of 6 credit hours of research resulting in a document that clearly demonstrates graduate level accomplishments of the student, followed by a defense examination; minimum total credits for degree is 36;
   (b) Professional experience: a minimum of 12 additional hours of coursework including 6-12 hours in an internship with a public or private organization, followed by a comprehensive examination; minimum total credits for degree is 42; or
   (c) Additional coursework: a minimum of 12 additional hours of coursework followed by a comprehensive examination; minimum total credits for degree is 42.

Doctor of Philosophy

Students in the Ph.D. program must complete the M.S. core courses, or an equivalent, and all other requirements for the degree as noted elsewhere in the catalog.

CONCURRENT DEGREES

Concurrent degree programs are also offered between GPES and Syracuse University's Maxwell School of Citizenship and Public Affairs, S.I. Newhouse School of Public Communications, School of Education, College of Law, and the School of Management. Students seeking concurrent degrees with Syracuse University are advised to state that desire clearly in their applications; in such cases, students must also meet the entrance and degree requirements of the appropriate Syracuse University Colleges and Schools. However, students may not apply for the concurrent degree option until they have completed at least one semester of graduate level coursework and earned a cumulative grade point average of at least 3.500. At the completion of the first year of law school, students at the Syracuse University College of Law may apply for admission to the GPES program at ESF.

THE FACULTY OF FOREST ENGINEERING

ROBERT H. BROCK, *Chairman*
312 Bray Hall
(315) 470-6633

ROBERT H. BROCK, *Chairman* (Photogrammetric and Geodetic Engineering, Geo-spatial Information Systems)
DUGGIN (Agricultural Assessment, Remote Sensing, Physics), HASSETT (Environmental Engineering, Water Resources), HOPKINS (Surveying, Geo-spatial Information Systems, Remote Sensing), LEE (Computers and Systems Engineering, Transportation and Equipment, Soil Mechanics), MCCLIMANS (Soils, Hydrology, Site Engineering), PALMER (Engineering Economics, Energy, Production and Harvesting Systems), TOLL (Environmental Monitoring, Risk Assessment, Environmental Policy), TULLY (Structures, Engineering Hydrology, Water Resources).

A large portion of our nation's resources exists on forested and rural lands. These include: the increasingly valued renewable resources of timber, biomass and wildlife; the sustaining resources of water, soil and nutrients; and the derivative resources of paper, wood, and fibrous products and recreation and amenity values. Forest engineering is a unique field of engineering which is concerned with the design of systems and facilities to improve the sustained high quality yield of resources and multiple use benefits of goods and services from forested and rural lands.

The undergraduate curriculum in Forest Engineering provides a broad base of study and specialized education in engineering with an emphasis on site development for improved resource use and conservation. Instruction focuses on: locating and quantifying resources; designing harvesting, conveyance and transportation systems and networks for water and timber; designing structures, facilities and pollution abatement systems; and engineering planning for the development of sites and regions for multiple use.

Because of the special importance of continual measurement and evaluation of the broad scaled parameters which affect the resource base, unique opportunities for study are available for students aiming toward professional careers involving the conceptualization, design, and maintenance of geographically referenced resource information systems. This includes elements of surveying, photogrammetry, remote sensing, and resource information systems design.

Lower Division Courses

Students entering through the freshman residency program will follow the curriculum described on page 39.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
Biology	3
General Chemistry with Laboratory	8
Engineering Physics with Laboratory	8
Calculus through Differential Equations	15
English	6
Economics (Macro- and Microeconomics)	6
Engineering Drawing (Graphics)	1
Computer Programming	3
Engineering Mechanics (Statics and Dynamics)	5
Electrical Science	3
Humanities or Social Science Electives	3
TOTAL MINIMUM LOWER DIVISION CREDITS	61

Upper Division Courses

Junior Year		*Credit Hours*
First Semester	ERE 362 Mechanics of Materials	3
	ERE 371 Surveying for Engineers	3
	FOR 321 General Silviculture	3
	CIE 327 Principles of Fluid Mechanics	4
	EFB 335 Dendrology	2
	Elective	3
		18
Second Semester	FEG 340 Engineering Hydrology and Flow Controls	4
	FEG 350 Introduction to Remote Sensing	2
	FEG 363 Photogrammetry I	3
	MEE 285 Introduction to Computers in Design	3
	APM 395 Probability and Statistics for Engineers	3
	ERE 351 Basic Engineering Thermodynamics	2
		17

Senior Year		*Credit Hours*
First Semester	FEG 410 Structure I	4
	FEG 420 Harvest Systems Analysis	1
	FEG 430 Engineering Decision Analysis	3
	CIE 337 Soil Mechanics and Foundations I	3
	FOR 477 Resource Policy and Management	3
	Elective	3
		17
Second Semester	FEG 454 Power Systems	2
	FEG 437 Transportation Systems	3
	ERE 440 Water Pollution Engineering	3
	FEG 489 Forest Engineering Planning and Design	3
	Elective in Engineering Design Sequence	3
	Elective	3
		17
	TOTAL MINIMUM UPPER DIVISION CREDITS	69

Undergraduate Program

The primary objective of this degree program is to prepare qualified engineering graduates to operate with professional competence within the context of forest and natural resources development. The curriculum includes basic, forest, and engineering sciences. It utilizes elements of traditional engineering disciplines and develops its unique aspects from interweaving engineering design with an understanding of the natural environment and its renewable resource base including water, soil, timber, wildlife, and amenity values. Studies in the humanities and social and economic sciences are integrated throughout the curriculum to help achieve a broad and balanced perspective of professional practice in forest engineering.

Forest Engineering students with an interest in graduate study can plan their undergraduate studies along an individualized track which will prepare them for a Master of Science program in environmental and resource engineering at ESF. In this way, Forest Engineering students who qualify will be admitted to a quality graduate program with minimal inconvenience or interruption in their studies.

In addition, qualified graduates in search of advanced degree education enjoy ready acceptance to engineering graduate schools throughout the country. Graduates of the Forest Engineering curriculum may enter an established five-year program in either civil, or mechanical engineering at Syracuse University. A bachelor of science degree in engineering will be awarded by Syracuse University upon completion of the requirements of the fifth year.

To enter the Forest Engineering curriculum at the junior level, a transferring student must have acceptable college credit in the following coursework areas or be able to have suitable coursework substitutions for courses listed in the junior and senior years.

The curriculum in Forest Engineering is accredited by the Engineering Accreditation Commission/Accreditation Board for Engineering and Technology (EAC/ABET).

TOTAL UPPER AND LOWER DIVISION ELECTIVE REQUIREMENTS

For those students entering the Sciences and Engineering Track with the intention of pursuing the upper division program in Forest Engineering, the following guidelines should be considered when planning their program.

Humanities or Social Sciences: Electives taken throughout the full four-year curricula must include at least 9 credit hours in social sciences or humanities, at least 3 of which are recommended to be upper division. Humanities coursework deals with branches of knowledge concerned with man and his culture, while social sciences coursework concerns individual relationships in and to society. Traditional subjects in these areas are philosophy, religion, history, literature, fine arts, sociology, psychology, anthropology, economics, and modern languages beyond the introductory skills courses, while modern nontraditional subjects are exemplified by courses such as technology and human affairs, history of technology, and professional ethics and social responsibility. Subjects such as accounting, industrial management, finance, personnel administration, ROTC studies, and skills courses, such as public speaking and technical report writing, do not fulfill the humanities and social science content.

Students having advanced placement credits are encouraged to work closely with their advisor in order to best prepare for various upper division elective sequences in technology, science, design or management.

Engineering Sciences: Electrical Science and coverage of Dynamics (separately or in combination with Statics) are required.

Engineering Design: At least 3 credit hours are required in upper division engineering coursework as part of an advisor approved sequence which complements other forest engineering coursework and provides the equivalent of at least 1 credit hour of depth in the design and synthesis component of the program, such as:

Structures II
Soil Mechanics II
Air Pollution Engineering
Photogrammetry II
Synthesis of Mechanical Systems
Advanced Topics in Hydraulics

A total of 130 credit hours is required to complete the B.S. degree in Forest Engineering.

Graduate Opportunities

Through the program in environmental and resource engineering, the faculty participates in graduate education leading to the Master of Science and Doctor of Philosophy degrees.

Graduate studies and research are primarily concerned with environmental and resource related programs. Successful and individual programs of graduate study may be efficiently designed by students with bachelor of science degrees in engineering or in forestry, natural sciences, physics, or mathematics.

See page 42 for more information on graduate study in environmental and resource engineering.

Support for graduate study and research in these areas is both internal and external. The internal support includes modern laboratory and instrumentation facilities in the Engineering Faculties at both ESF and in the Engineering School at Syracuse University. Exceptional support exists for programs in environmental engineering measurements in the form of remote sensing and photogrammetric laboratories and the extensive forest properties owned by the College at which research may be conducted.

External support comes from several active sources, including industrial, commercial and governmental. Over the past two decades, close cooperation has developed special study and research opportunities with these sources.

THE FACULTY OF FORESTRY

BOB G. BLACKMON, *Chairman*
107 Marshall Hall
(315) 470-6536 / 6535

BOB G. BLACKMON, *Professor and Chairman*
(Soils, Forestry Education)

Syracuse Campus

ABRAHAMSON (Entomology, Pathology, Pesticides), ANDERSON (Forest Management), BENNETT (Economic Theory, Economic Thought in Forestry), BLACK (Water and Related Land Resources), CANHAM (Forestry Economics, Regional Economics, Natural Resource Economics), COUFAL (Silviculture, Forest Education), CRAUL (Forest and Urban Soils), CUNIA (Operations Research, Biometry), DALL (Environmental Law and Policy), DAVIS (Forest Management, Timber Harvesting), DAWSON (Tourism Planning, Commercial Recreation), DREW (Tree Physiology, Forest Autecology), ESCHNER (Forest Influences, Forest Hydrology), GRATZER (Forest Recreation, Forest Management), HERRINGTON (Forest Management-Computers, Micrometeorology), HORN (Forest Management, Law), HOWARD (Silvics, Forest Management), KOTEN (Forest Management, Management Science and Planning), MAYNARD (Tree Improvement), MONTEITH (Forestry Economics, Land Use, Continuing Education), MORRISON (Forest Recreation), NYLAND (Silviculture, Forestry Practice), PETRICEKS (Resource Economics, International Forestry Economics), RICHARDS (Silviculture, Urban Forestry), SHANNON (Forest Policy, Forest Resources Sociology), STEHMAN (Statistics), WHITE (Forest Soils, Silviculture).

Forest Technology Program—
Ranger School, Wanakena, New York

MILLER (Roads, Installations, Timber Harvesting), O'NEILL (Ecology, Forest Management, Forest Protection), REMELE (Dendrology, Aerial Photogrammetry, Silviculture), WESTBROOK (Surveying, Personnel Management, Soil).

Adjunct Faculty

CASTRO (Social Forestry, International Forestry), FINGER (Environmental Communication and Politics), HORSLEY (Silvics), MARQUIS (Silviculture), NEUHAUSER (Environmental Science and Renewable Resources), ROWNTREE (Urban Forestry), SLOAN (Policy), STITELER (Statistics), TABER (Extension Programs), YAWNEY (Silviculture), ZIPPERER (Urban Forestry).

The educational program in the Faculty of Forestry leading to the first professional degree (Bachelor of Science) in forestry, is accredited by the Society of American Foresters (SAF). SAF is a specialized accrediting body recognized by the Council on Postsecondary Accreditation and by the U.S. Department of Education as the accrediting body for forestry in the United States.

MISSION

The ESF Faculty of Forestry, one of the nation's major forestry programs, shares with companion forestry schools a search for truth and excellence through the scholarly endeavors of instruction, research, and public service. The Faculty of Forestry seeks to enlarge the body of knowledge in forestry and natural resources and to share that knowledge with society. The Faculty strives to provide quality educational opportunities which encourage students to think critically, synthesize knowledge, communicate effectively, and utilize technology responsibly. The Faculty of Forestry serves a worldwide clientele, and thus has a major responsibility for educating students to function effectively in their own and in other cultures.

Programs of the Faculty of Forestry are designed to assist society in the development, protection, and management of forest resources of the state, region, nation, and the world. The mission encompasses the forest's commodity and social values such as wood, water, recreation, wilderness, and aesthetic beauty. Implicit in the mission is the dynamic interrelationship between forests and the human population.

To carry out the mission of the Faculty of Forestry, several educational programs are offered: Associate of Applied Science, Bachelor of Science, Master of Science, Master of Forestry, and Doctor of Philosophy. In addition, the Faculty contributes to the body of knowledge through an active research program, and extends information to appropriate clientele through public service activities and a program of continuing education.

SUPPORT GOALS

1. To provide opportunity for education at the associate degree level in forest technology to prepare graduates for careers as forestry and natural resource technicians in private and public sectors, or as preparation for pursuit of baccalaureate education.
2. To provide opportunity for undergraduate collegiate-level education in resources management that prepares graduates to assume positions in industry, public agencies, and consulting firms, at the entry level but with sufficient breadth and depth of education to allow them to assume increasing responsibility to at least the middle management level.
3. To prepare undergraduates for pursuit of graduate education at any of the world's graduate programs in forestry, natural resources, environmental science, or related disciplines.
4. To provide opportunities for graduate study at the master's level through a Master of Forestry program which enables graduates to pursue careers in operations and management of forest resources at the middle management level and beyond.
5. To provide opportunities for graduate study at the master's level through the Master of Science degree leading to employment in forestry and natural resource management and/or preparation for further study at the doctoral level.
6. To provide opportunities for advanced graduate study through the Ph.D. program, providing graduates with the technical, scientific and professional base to become leaders in forestry and related natural resource professions through employment in research, higher education, and managerial positions.
7. To provide students in the Environmental Studies program (Policy and Management Study Area) with

the educational background to understand the concepts and skills pertinent to dealing with environmental policies and management of environmental programs, and to support other interdisciplinary programs in the Faculty of Forestry and across the College.

8. To maintain and enhance world-class research programs that add to the body of knowledge and, through publication of research results, contribute to state, regional, national, and worldwide informational needs of the forestry community.
9. To maintain a program of continuing education that extends knowledge through workshops, seminars, symposia, and publications.
10. To provide an atmosphere that fosters an appreciation for the liberal arts and humanities and an understanding of the relationship between these disciplines and the biophysical sciences.
11. To contribute to the total educational program of the College by offering service instruction at both undergraduate and graduate levels.
12. To instill in students a sense of community based on common goals, values, and expectations, and to provide them with an environment that fosters both individual creativity and an appreciation for the cooperative spirit.
13. To address through undergraduate and graduate instruction, research, and public service the complexities of the socioeconomic and political environment in which modern resource management is practiced.
14. To provide an atmosphere which fosters a positive learning and working environment for, and to be proactive in, recruiting women and members of underrepresented groups.

Undergraduate Program in Resources Management (Forestry)

Professional forestry consists of a blend of environmental, social, economic, and biophysical disciplines as they relate to natural resources, and the ESF setting is ideal for teaching the interaction of these subjects. Syracuse is located in the center of the country's second most populous state. Urbanization and development in certain parts of New York and the Northeast are increasingly creating important land-use issues and conflicts. At the opposite end of the land use spectrum, wilderness is also very much present in New York. Within an easy drive of the campus lies the six-million-acre Adirondack Park, the oldest and largest wilderness area east of the Rockies. The park is only a few hours from New York City and other heavily populated areas. In fact, New York State's forests are located within a day's drive of almost one-third of the U.S. population.

Recreation accounts for another key use of New York's forests. The many ways in which people enjoy the forests—whether as campers, hikers, skiers, vacationers on mountain lakes—have many outlets within the state. From the Catskill Park north of New York City, to the Allegany State Park in the southwest corner of the state, to the Adirondack Park, this and other intense public uses of the forest give the Faculty of Forestry the opportunity to teach students the various alternatives for dealing with the many issues that develop as modern society continues to interface with the forest.

In addition, there are approximately 500,000 private forest land owners in the state, many of whom are deriving financial return from their forests. The forest products industry is a vigorous part of the New York economy, employing 88,000 people and accounting for a payroll of about $1.1 billion each year. The Faculty of Forestry recognizes the economic as well as social benefits of the forest, and strives to give its students an understanding of forest management that is both financially and environmentally sound. Many private forests are located near Syracuse and are used in teaching.

Lower Division Courses

Students entering through the freshman residency program will follow the curriculum described on page 40.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
Biology (Botany and Zoology preferred) with Laboratory	8
General Chemistry with Laboratory	8
Physics I with Laboratory	4
Calculus I	3
Economics (Microeconomics required)	3
Political Science (U.S. Institutions)	3
Introductory Sociology **OR** Introductory Psychology	3
Computer Applications	3
*English	6
**Social Science/Business Electives	9
***Mathematics/Physical Science Electives	6
****Free Electives	8
TOTAL MINIMUM LOWER DIVISION CREDITS	64

*Standard freshman English sequences are acceptable, but where possible the student is strongly urged to take technical report writing.

**Courses in sociology, psychology, U.S. history, macroeconomics, political science, anthropology, U.S. geography, business, finance, or accounting.
Note: Students may be admitted with only 9 credit hours of the required or elective courses in economics, political science, psychology/sociology and social science/business areas. The remaining 9 credit hours of deficiencies must be made up as early as possible in the student's ESF program, including the use of summer sessions.

***Courses in mathematics, physics, chemistry, computer science, meteorology, logic. Math courses must be of a level equivalent to Calculus II or be in some way complementary to Calculus I.

****Free electives and electives in the specified categories should be chosen with the clear idea that they are in preparation for an upper-division, professional program. Courses in the free elective category that have been found to be helpful include personnel management, group dynamics, technical report writing, speech, foreign language, logic, ethics, pre-calculus math, first aid and CPR, graphics/drafting, surveying, real estate, marketing, conservation law, ecology, dendrology, plant pathology, philosophy, religion, fine arts or other arts, sciences, or business courses. Free electives can also include further courses from the directed elective categories. All electives should be chosen with the particular career goals of a student in mind.

In essence, forestry is a broad academic endeavor. Education about the forest itself is founded in basic biophysical subjects such as biology, chemistry, physics, and mathematics. But as we approach the 21st century, forestry has become much more than the forest. Thus, in addition to the biophysical subjects and basic forestry, students are given an appropriate mix of social and environmental sciences, and communications. The result, we believe, is a graduate who can effectively deal with land and resource issues in a complex and ever-changing society. The Faculty of Forestry offers three undergraduate degree programs designed for students planning different career paths:

1. A professional forestry and natural resources management degree program, leading to a bachelor of science degree, offered at the Syracuse campus. A minor in management, using courses from Syracuse University's School of Management, is available within this program. It enables students to acquire specific additional managerial skills (see p. 65 for details).
2. A dual major program, leading to a bachelor of science degree, that meets the requirements of both the forestry and the environmental and forest biology degree programs. For details, see p. 46.
3. A forest technology degree program, leading to the associate's degree, offered at the Ranger School campus. For details, see p. 65. It is possible to transfer from this program to the bachelor degree programs, as explained on page 66.

The professional forestry and resources management program prepares students to manage forests and related resources for human benefit, while protecting and enhancing the environment. Through a carefully designed sequence of required courses and electives, students learn the principles and applications of forest ecology, techniques of forest measurement, and the principles of economic and managerial policy and administration. Electives allow students to concentrate their study in special areas of forestry or to broaden their education to fulfill personal or professional needs.

A seven-week summer field session at ESF's Warrensburg Campus is the starting point of the program. This session emphasizes field skills and techniques, and introduces basic ecological and managerial concepts. *The summer session is required prior to registration for the junior year.*

The summer field session is followed by a highly integrated semester which includes an introduction to the physical environment (soils, and forest influences, which covers meteorology and hydrology), study of physical and biological influences on tree growth and development (silvics), and the manipulation of the ecosystem which can be made to take advantage of these responses (silviculture).

Electives comprise about one-fourth of the curriculum and allow students to shape their programs to meet their individual needs and interests. For example, one student might distribute electives among all areas of forestry's multiple uses, while another might concentrate them in areas such as watersheds, forest wildlife, recreation, entomology, pathology, soils, international forestry, or urban forestry. Electives may be taken at ESF and Syracuse University. Common SU electives are geography, business management, and

Upper Division Courses

Course Area			*Credit Hours*
Summer:	[1]Summer Program in Field Forestry		
	FOR 301	Field Dendrology	1
	FOR 302	Forest Surveying and Cartography	2½
	FOR 303	Introduction to Forest Mensuration	3½
	FOR 304	Introduction to Forestry	1
			8

[1]**SUMMER PROGRAM IN FIELD FORESTRY**—7 weeks, 8 credit hours: Required of all students (except Forest Technology graduates and students from either Paul Smith's College or Morrisville Agricultural and Technical College, and others who have completed a specific sequence of courses with the approval of their Pre-ESF advisor) prior to registration for junior year. Other two-year programs will be evaluated on a case-by-case basis.

Junior Year

First Semester	FOR 305	Forestry Concepts and Applications	1
	FOR 322	Forest Mensuration	1
	FOR 331	Forest Influences	3
	FOR 332	Silvics	3
	FOR 333	Silvics Laboratory/Practicum	1
	FOR 334	Silviculture	4
	FOR 345	Soils	3
			16
Second Semester	FOR 360	Principles of Management	3
	FOR 370	Management of the Forest Enterprise	3
	APM 391	Introduction to Probability and Statistics	3
	[2]Electives		6
			15

Senior Year

First Semester	APM 492	Forest Biometrics	3
	FOR 400	Forest and Resource Economics	3
	FOR 461	Management Models	3
	[2]Electives		6
			15
Second Semester	FOR 465/665	Natural Resource and Environmental Policy	3
	[2]Electives		14
		TOTAL MINIMUM UPPER DIVISION CREDITS	71

[2]There are 26 credit hours listed as "elective." Of these, nine (9) credit hours must deal specifically with at least two major resources (forage, minerals, recreation/amenities, water, wildlife, or wood), and another three (3) credit hours must be in the area of forest protection (entomology, pathology, or fire). The remaining 14 credit hours are free electives. Of the total 26 credit hours of directed and free electives, at least six (6) must be taken in two or more Faculties at ESF other than Forestry.

A total of 135 credit hours is required to complete the B.S. degree in the Professional Forestry and Resources Management Curriculum.

communications. Careful use of electives allows the student to tailor his or her educational experience to a social emphasis such as outdoor recreation or urban forestry, or to an economic/financial/management emphasis through a minor in Syracuse University's School of Management, or a strong biological and environmental science emphasis.

Elective courses are selected with the assistance of a faculty advisor, and should be planned early in the student's course of study. The student may elect to pursue a variety of independent or group study activities. These may be conducted in whole or in part at any one of the College's several campuses, off campus at another institution, or in cooperation with some resource management agency or firm. Proposals for off-campus study are subject to faculty review and approval and are carried out with faculty guidance to ensure adherence to academic standards.

A total of 135 credit hours is required to complete the B.S. program. Students contemplating entering it should have completed at least 64 semester credit hours or have earned an associate degree; further, a minimum of 56 of these credit hours must be distributed among specific course areas as outlined on page 63. Students who have completed more than 64 lower-division credits may transfer up to 12 additional hours of junior-senior level courses and should seek advice on upper division credits at the time of matriculation. The professional forester must understand both the biological and social influences that affect forest resources. Prospective students should thus choose lower-division electives to broaden and enhance their communication skills and their understanding of social and political sciences and humanities.

Minor in Management

The resources management program, as described above, contains a core of knowledge of both resources and management sciences sufficient for the practice of forestry and related resources management. Students use electives to shape programs that meet their career objectives. Using some of these electives, the minor in management provides a formal, focused opportunity to expand and broaden managerial skills, and is recognized via appropriate notation on the student's official transcript.

Using a part of the 26 credit hours of upper-division electives, the minor in management requires completion of five

CURRICULUM FOR COMBINED FOREST TECHNOLOGY AND PROFESSIONAL FORESTRY PROGRAMS*

Freshman Year
(Completed at a college of the student's choice)

	Credit Hours
Biology (Botany and Zoology preferred), with Laboratory	8
English (A technical report writing course is highly recommended.)	6
Calculus I	3
Microeconomics	3
General Chemistry, with Laboratory	4
Physics I, with Laboratory	4
Political Science (U.S. Institutions), **OR** Introductory Sociology, **OR** Psychology, **OR** Computer Use	3
MINIMUM TOTAL CREDITS, FRESHMAN YEAR	31

Sophomore Year
(Wanakena Campus)

FTC 200 Dendrology I	2
FTC 202, 203 Plane Surveying I and II	5
FTC 204, 205 Forest Mensuration and Statistics I and II	5.5
FTC 206 Forest Ecology	3
FTC 207 Aerial Photogrammetry	3
FTC 208 Allied Technologies	3
FTC 209 Forest Roads	2
FTC 211 Silviculture	2.5
FTC 213, 227 Forest Protection I and II	4
FTC 214 Personnel Management	1.5
FTC 215 Timber Harvesting	2
FTC 217 Forest Management	3.5
FTC 218 Forest Recreation	1.5
FTC 219 Elements of Wildlife Ecology	1.5
FTC 221 Soil and Water Measurements	1.5
FTC 223 Graphics	1
FTC 228 Structure and Growth of Trees	1.5
FTC 229 Silviculture II **OR** FTC 230 Plane Surveying III	2
TOTAL CREDITS, SOPHOMORE YEAR	46

Summer between Ranger School graduation and start of Junior Year

General Chemistry II, with Laboratory	4
Two courses fulfilling requirements for **either** Political Science (U.S. Institutions)/Introductory Sociology/Introductory Psychology/Computer Use; **OR** Social Science/Business Electives; **OR** Mathematics/Physical Science Electives (See footnotes on page 63 for specifics.)	6
TOTAL CREDITS, SUMMER COURSES	10

Junior Year

FOR 305 Forestry Concepts and Applications	1
FOR 322 Forest Mensuration	1
FOR 331 Forest Influences	3
FOR 332 Silvics	2
FOR 333 Silvics Laboratory/Practicum	1
FOR 334 Silviculture	4
FOR 345 Soils	3
FOR 360 Principles of Management	3
APM 391 Introduction to Probability and Statistics	3
Social Science/Business Elective	3
Mathematics/Physical Science Elective	3
Professional Elective	3
TOTAL CREDITS, JUNIOR YEAR	30

Senior Year

APM 492 Forest Biometrics	3
FOR 400 Forest and Resource Economics	3
FOR 461 Management Models	3
FOR 465/665 Natural Resource and Environmental Policy	3
Mathematics/Physical Science Elective	3
Professional Electives	11
Social Science/Business Elective	6
TOTAL CREDITS, SENIOR YEAR	32

*This model is meant for those students who have the initial intent of attending the Forest Technology (Ranger School) and Professional Forestry Programs.

courses from the Syracuse University School of Management. Three of these courses are required, covering the legal system, money and banking, and marketing and society. The other two courses are selected from among lists of *recommended* and *acceptable* courses, with topics ranging from organizational behavior to labor relations, from corporate finance and operations management to real estate. Along with microeconomics and statistics, both part of the resources management degree program, students wishing to pursue a minor in management must take accounting as prerequisite to the minor, and are advised to take it as one of the lower-division electives.

Students must declare their intent to undertake the minor in management early in the fall semester of the junior year, using an application approved by the student's advisor and the Faculty of Forestry Undergraduate Education Coordinator. A G.P.A. of 2.500 in lower division coursework is required for admission.

Transfer from the Ranger School

Given the nature of the Forest Technology Program at Wanakena, students entering from the Ranger School are not required to attend the Summer Session in Field Forestry, the 8-credit-hour field experience other incoming juniors must attend. Instead, Ranger School transfer students are encouraged to use the summer prior to the junior year to complete the lower-division requirements as outlined on page 65. The time spent on completing the bachelor's degree is thus two years for all students, but the configuration of courses differs somewhat between community college and Ranger School graduates.

There are several advantages to combining a Ranger School education with a baccalaureate program at ESF's Syracuse Campus. At the end of two years, Ranger School graduates have had a chance to explore some of the varied facets of forestry, an experience which can prove helpful when choosing electives. In addition, Ranger School graduates have earned an A.A.S. degree in forestry, and those who choose to work for a time before beginning the baccalaureate will have marketable skills. Most importantly, Ranger School graduates who go on to pursue the bachelor's degree have a solid field-oriented technical education as well as a managerial orientation and the deeper ecological and social understanding provided by the professional curriculum.

Graduate Education

The Faculty of Forestry offers two graduate programs: Forest Resources Management, leading to the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) in a variety of areas, and Forest Management and Operations, leading to the Master of Forestry (M.F.) degree. The Faculty of Forestry will also award up to 8 credit hours for suitable Peace Corps service. Further details are available from the Graduate Studies/Research Coordinator.

Joint study with other SUNY ESF faculties and with Syracuse University is also possible. In a number of areas, particularly forest biology, programs of study can be established which formally include members of other faculties of the College. Programs which provide the student with two master's degrees, one from SUNY ESF and another from Syracuse University, are available with the following SU schools:

- School of Management
- Maxwell School of Citizenship and Public Affairs
- College of Law
- Newhouse School of Communications
- School of Education

The joint degree programs usually add an additional year of study to a normal master's program of study. To be eligible, a student must have been matriculated at the College for at least one semester, must have a grade point average of at least 3.500, and must be formally accepted into a joint degree program.

FOREST RESOURCES MANAGEMENT (M.S., Ph.D.)

Graduate study programs in forest resources management are created to suit the needs of each individual student and are designed to prepare students for careers in resource administration, management, scientific research, professional education, and a variety of other specialized positions related to forest resources management. Students with non-forestry bachelor's or master's degrees and a strong interest in Forest Resources Management are also encouraged to apply.

All candidates for the M.S. and Ph.D. must take two semesters of seminar (FOR 797) for each advanced degree they pursue. Candidates for the Ph.D. must also present a graduate seminar on their respective thesis topics. Additional graduate requirements are set by the College of Environmental Science and Forestry and discussed on pages 29-34.

Each graduate student selects (or is assigned) a faculty advisor who acts as the director of the student's study plan. The student and advisor are assisted in planning the program, and in determining successful completion of the program, by at least two other faculty members, who serve as the student's steering committee.

All three of the College's master of science program alternatives (thesis, professional experience, or coursework) are available to master's degree students in the Forest Resources Management program. Students select the appropriate alternative in consultation with their committees. The master's degree usually takes two years of study.

Doctoral study is normally built upon a master's degree, but in some instances it can be undertaken directly after a baccalaureate degree. Doctoral programs usually involve 30 hours of formal coursework beyond that required for the master's degree. Written and oral candidacy examinations, intended to test the student's mastery of subject matter essential to the dissertation topic, are required, as is an oral defense of the dissertation.

AREAS OF STUDY

Thirteen areas of study in the Forest Resources Management program are described below, highlighting examples of *current* faculty and student interest and activity. These examples do not indicate the full range of faculty interest. Similarly, these examples are meant *only* as highlights; many students have programs encompassing two or more areas of study.

POLICY AND ADMINISTRATION

Participating Faculty: BLACK, DALL, HORN, SHANNON

- Policy issues and analysis
- Administrative organization and management
- Program implementation

Graduate study in the area of resources policy and administration is designed to prepare students for positions at the planning, budgeting, programming, and operating levels of public agencies and businesses. The expanded regulatory role of federal and state government over resource use and land management has brought substantially increased need for thorough understanding of policy matters,

legal requirements, and governmental and political interactions with resource owners and users.

Programs of study include advanced courses, seminars, and special problems structured around these needs and the complex interrelationships of society and resources. Students are encouraged to round out their academic programs through courses offered by other units of the College and at Syracuse University. Interested students with undergraduate preparation in such areas as forestry, liberal arts, and engineering can be served through the creation of a study program that complements work already taken. The broad array of courses and the diverse points of view available allow the student to build a program to meet specific career objectives.

FORESTRY ECONOMICS

Participating Faculty: BENNETT, CANHAM, MONTEITH, PETRICEKS

- Timber and wood-using industry economics
- Regional economic impacts
- Economics of nonmarket goods

Graduate study in forestry economics prepares students for employment as forest economists or resource analysts with federal and state agencies and with private industry. Graduates with the Ph.D. usually pursue careers in teaching or research. The goals of study in this area are depth of understanding and familiarity with economic tools contributing to making competent decisions in resource economics, management, and policy. Students with undergraduate degrees in forestry or forest products can undertake graduate study in forestry economics. By adding courses in forestry, graduates with liberal arts, engineering, or business degrees can also enter the program.

The core of the student's program consists of courses in forestry and resource economics. In addition, the student must be aware of the social and biological environment in which forestry economics is applied. Thus, the core program is supplemented by courses in general economics, statistics and operations research, resource policy, business administration, and related managerial and biological fields. The program draws on course offerings and facilities of the College and of Syracuse University. Individual programs are tailored to fit the student's particular interest. Some examples are the economics of timber management, land use economics, economics of natural environments, economic development, and forestry.

FOREST MANAGEMENT

Participating Faculty: COUFAL, DAVIS, GRATZER, HERRINGTON, HORN, KOTEN, NYLAND, SHANNON

- Resource information systems
- Resource planning and scheduling
- Forest operations
- Timber and multiple-use management

Graduate study in forest management requires a broad knowledge of the natural and societal environments as the basis for understanding how these environments affect (or are affected by) the development and use of forests and associated wildlands. Forest management focuses on the planning and implementation processes necessary to achieve integrated use of forests and associated natural resources. The educational objective is to develop expertise sufficient for capable, professional resource management under a variety of natural and societal environments.

Study programs are flexible, and students may pursue special interests in a single product, several products or services, tools and processes of planning for integrated forest use, or in developing managerial skills. The program's emphasis, however, lies in applying the skills and knowledge to the management of forest lands. Where appropriate, students may take courses at Syracuse University's School of Management and Maxwell School of Citizenship and Public Affairs to complement the College's offerings. Recent graduates have found employment with private and public organizations that own, manage, use, or relate in more indirect ways to forest resources. Students with the doctorate have engaged in research and teaching.

RECREATION AND TOURISM

Participating Faculty: DAWSON, GRATZER, MORRISON

- Commercial and recreation tourism
- Recreation resource planning
- Wilderness and river recreation

Graduate study in this area equips students with a broad understanding of the nature and purpose of outdoor recreation and how it relates to natural resources. The program emphasizes the role of and interrelationships between the public and private sectors in providing recreation and tourism facilities, services, and programs. Individual programs combine study in resources management with relevant studies in the social and political sciences and the development of analytic capabilities needed to implement management plans and programs. Other faculties of the College and within Syracuse University, treating such areas as planning, design, and education, provide a wide range of supporting courses and facilities.

WATERSHED MANAGEMENT/ HYDROLOGY

Participating Faculty: BLACK, ESCHNER, HERRINGTON

- Hydrology
- Snow hydrology
- Soil and water conservation
- Meteorology/micrometeorology
- Water resources policy

Graduate study of watershed management/hydrology, as related to forest influences, includes energy exchange between forest and atmosphere; moderation of urban environments by vegetation; soil and slope stability; and watershed hydrology, including snow. Forest influences include all of the effects resulting from the presence of forest trees and associated vegetation on climate, the hydrologic cycle, erosion, floods, and soil productivity. Health considerations and human comfort, often included in older definitions of forest influences, are assuming even greater importance, given our growing concern for the environment.

Graduates with concentrations in this area fill a variety of positions in research, teaching, and public and private management as watershed management specialists, hydrologists, environmental officers, meteorologists, and ecologists.

SILVICULTURE

Participating Faculty: ABRAHAMSON, COUFAL, HOWARD, NYLAND, RICHARDS, WHITE

- Hardwood silviculture
- Conifer plantations
- Biomass production
- Greenspace silviculture

Graduate study in silviculture stresses the nature of cultural treatments, the theories underlying them, and the biological, physical, and social constraints to their implementation. Silviculturists study stand treatments for their value in producing

goods and services and maintaining or enhancing productivity for the future.

Students in silviculture progress, through formal coursework and research, toward an understanding of how cultural treatments affect the balanced, sustained supply of wood, water, wildlife, recreation opportunities, and amenity values. One major area of emphasis relates to treatment of tree stands for their continued production of wood products and other commodities. Another centers on stand treatment for several values simultaneously, where the harmonious integration of uses is of concern. A third focuses on evaluation and manipulation of vegetation systems, primarily for their on-site values, such as recreation areas, highway and utility rights-of-way, and urban greenspace.

SILVICS

Participating Faculty: DREW, HOWARD

- Tree physiology
- Forest ecology
- Stand dynamics

Graduate study in silvics examines the scientific basis for the cultural treatment of forest vegetation by studying and defining interrelationships within forest ecosystems and cataloging intraspecific characteristics of tree species. In a sense, silvics is the ecology of managed forest ecosystems, though unmanaged and natural forests are often studied intensively to provide the benchmark conditions from which the silviculturist begins.

The specialist in silvics must work closely with colleagues in the basic disciplines, including soil physics and chemistry, micrometeorology and climatology, genetics and tree breeding, plant ecology and physiology, wildlife biology, entomology, and pathology.

FOREST SOIL SCIENCE

Participating Faculty: CRAUL, WHITE

- Acidic disposition
- Soil physical properties
- Morphology and classification
- Soil chemistry/fertility

Graduate study in forest soil science may be directed toward soil science as it relates to goods and services produced, or to the impact of management practices on environmental quality. Study may include evaluation of ecosystems to quantify nutrient element balances and cycling, amelioration of soils for maintaining increasing ecosystem productivity, and the impact of various land-use practices on soil properties. Other areas may include use of soils information in geographic information systems, ecological land classifications, and the development of expert systems that provide soil use interpretations from remotely sensed data.

Modern well-equipped laboratories are available for plant, soil, and water chemical analyses; soil physical characterization such as water relations, compaction, aeration, and temperature regimes; and other soil property investigations. The extensive College properties permit forest soil research to be conducted under a wide variety of environments and ecological conditions.

TREE IMPROVEMENT

Participating Faculty: MAYNARD

- Clonal propagation/tissue culture
- Genetic selection and testing
- Seed orchard management

Graduate study in tree improvement—a field devoted to developing populations of trees that are well adapted, rapid growing, and free of disease—involves formal coursework in plant biochemistry and physiology, statistical genetics, and plant breeding. Tree improvement programs are also used to increase the aesthetic or recreational value of forest trees through selection for desirable traits.

Students use modern, well-equipped laboratories and greenhouses, and collect materials and perform field evaluations at many established test plantations. Graduates hold positions in seed orchard management, tree improvement, and forest genetics with private, state, and federal organizations.

INTERNATIONAL FORESTRY

Participating Faculty: DREW, GRATZER, PETRICEKS, SHANNON

- All phases of forest resources management

Graduate study in international forestry is designed for individuals who want to pursue internationally oriented careers in forestry and related fields. Instruction is aimed at supplementing and enriching the student's technical forestry knowledge and providing the broad background necessary for service in a variety of professional circumstances: forestry advisor, teacher, or research specialist with national and international agencies, private business and industrial firms, philanthropic foundations, and voluntary service organizations whose activities include the development and use of forest resources in other nations.

At the master's level, students have the opportunity to gain competence in research methods, foreign languages, cultural anthropology, world geography, and international affairs, plus a solid understanding of the world forestry situation. At the doctoral level, the focus is on a specialized discipline area, such as forestry economics, forest policy and administration, forest management, or silviculture.

Syracuse University offers a wide variety of courses supporting the nonforestry elements of this area of study. Qualified candidates may undertake training and research in tropical forestry and related fields.

URBAN FORESTRY

Participating Faculty: CRAUL, HERRINGTON, RICHARDS, ROWNTREE, SHANNON

- Urban soils
- Urban climate
- Urban forest management/planning
- Urban tree management

Graduate study in urban forestry allows the student to pursue either of two broad objectives. Professional urban forestry skills may be enhanced through advanced coursework and applied research; students may also pursue more specialized study in soils, greenspace ecology, atmospheric science, forest science, tree improvement, forest resource inventory and evaluation, resource economics, and planning.

There is strong interaction with other urban-related areas of the College, including remote sensing, botany, pathology, entomology, wildlife ecology, and landscape architecture. Academic departments in Syracuse University's Maxwell School of Citizenship and Public Affairs—geography, economics, political science, sociology—cooperate with teaching and research programs, as does the U.S. Forest Service Northeastern Forest Experiment Station Urban Forest Research Project located on campus.

QUANTITATIVE METHODS

Participating Faculty: CANHAM, CUNIA, DAVIS, HERRINGTON, HORN, KOTEN, STEHMAN

- Statistics
- Forest inventory/mensuration

- Computer applications/modeling
- Operations research/systems analysis

Graduate study of quantitative methods is designed to develop skills in the application of mathematical, statistical, and computer-based problem analysis and solution. Study in this area is designed primarily for two types of students: those with undergraduate degrees in areas such as the biological sciences, forestry, wildlife, or agriculture, who wish to strengthen their quantitative skills, and those with degrees in mathematics, statistics, or computer science, who wish to focus on resources management.

Students may concentrate in statistics, operations research, biometry, forest mensuration, econometrics, and computer applications development. Syracuse University's computer facilities (the Center for Advanced Technology in Computer Applications and Software Engineering, or CASE Center) and the University's wide range of courses in mathematics, statistics, and quantitative methods, provide strong support for activities in this area.

RESOURCES INFORMATION MANAGEMENT

Participating Faculty: CANHAM, CRAUL, DAVIS, HERRINGTON, KOTEN

- Information management systems
- Systems analysis
- Geographic information systems application

Information is a vital part of any organization, and as the "information age" develops, management of information is becoming increasingly important to the success of any enterprise. Much of the information foresters and other natural resource managers work with is geographic in nature and is amenable to analysis by spatial techniques. Thus, the focus of Resources Information Management is the use of **Geographic Information Systems** (GIS) to manage information and provide the needed spatial analysis and modeling. However, nongeographic information is also important, and there is thus a need for traditional **Management Information Systems** (MIS) technology as well.

As with Quantitative Methods and Urban Forestry, Resources Information Management cuts across nearly all of the Faculty of Forestry's areas of interest. The strongest interactions are with faculty and students in Forest Management, Forestry Economics, Policy and Administration, Watershed Management/Hydrology, and Forest Soil Science. There are strong ties with the Faculty of Environmental Studies, the Faculty of Forest Engineering, working with remote sensing and photo interpretation, and the faculty in Syracuse University's Advanced Graphics Laboratory, Department of Geography, and the School of Information Studies.

At the master's level, students' programs tend to focus on the application of existing analysis techniques to resource management problems while at the doctoral level, the focus is on the development of analysis and modeling techniques. M.S. students thus apply Resources Information Management techniques to problems in their respective areas of interest, while Ph.D. candidates focus their energies on the mathematical, information science, spatial modeling, and computer science aspects of finding new ways to solve problems.

FOREST MANAGEMENT AND OPERATIONS (M.F.)

The Faculty of Forestry offers a professional graduate program in Forest Management and Operations leading to the Master of Forestry degree.

This graduate program is designed for students with an undergraduate forestry education and a primary interest in continuing their professional development through advanced study of the planning, management, and operations necessary for the appropriate use of forest resources. Thirty-seven credit hours of coursework are required in this structured, intensive 11-month program. Coursework begins during the latter part of the summer. No thesis is required, but students take a written comprehensive examination in the spring.

Courses in the M.F. program build on and extend the student's basic undergraduate forestry education and provide opportunities to relate theory to actual forestry situations. Emphasis is on methods and skills in modern business management, policy processes, forestry economics, and information systems. Developing managerial skills is a key objective. These skills are then applied to managing forestlands, operating associated enterprises, or using forest resources.

The Forest Management and Operations program consists of lecture courses, seminars, field experiences, and the written examination. The following course listing gives the content of the program.

Summer

Field Applications in Forest Management and Operations

Fall Semester

Finance (Private Industry) **or** Public Budgeting (Public Management)
Forest Resource Economics
Advanced Silviculture
Operations Management (Private Industry) **or** Public Administration (Public Management)
Information Systems for Forest Management
Seminar

Spring Semester

Pest Management for Forestry
Forest Policy
Organization and Human Behavior
Advanced Forest Management
Field Applications in Integrated Forest Management
Seminar
Elective

RANGER SCHOOL—FOREST TECHNOLOGY PROGRAM

History and Description

In 1912, some 1,800 acres of land in the Adirondack Mountains were donated to the College as a site for the development of a Ranger School. Since that time, the Forest Technology Program has trained over 3,000 graduates, most of whom are now working in a variety of forest activities, and it has earned the Ranger School a national reputation for excellence. The Program is administered by and is an integral part of the Faculty of Forestry. This relatively unique model of a single professional Faculty offering all levels of work from technical through post-doctoral emphasizes the teamwork approach to forest resource science and management espoused by the Faculty.

The two-year curriculum trains students in forest technology. The degree of Associate in Applied Science in Forest Technology (A.A.S.) is awarded. The objectives of the curriculum are to provide students with a knowledge of the field practice of forestry as related to forestry managerial needs; the ability to work and communicate effectively with professional and paraprofessional forestry personnel; and an understanding of the sciences and practices of forestry with some emphasis on ecological applications.

Graduates are generally classified as forest technicians, forestry aides (or surveying technicians) in initial employment positions. Forestry agencies and wood-

using industries employ forest technicians as an important part of their forest management teams, usually as the "people on the ground" who plan and execute the field practice of forestry, normally under the supervision of a professional forester. (Surveying firms employ 25 percent or more of the graduates each year to work with crews on road, boundary, right-of-way, mapping, construction, and exploration applications of plane surveying.)

The curriculum is designed to allow graduates immediate job entry at the technical level. Students interested in a baccalaureate degree in forestry and resource management should investigate the Faculty of Forestry's bachelor's degree curriculum described on page 63. It should be understood that transfer into the Faculty of Forestry's professional forestry curriculum, and other ESF bachelor's degree programs, is possible upon completion of the A.A.S. degree at Wanakena.

If a student feels transfer to a baccalaureate program is a possibility after graduation from the Forest Technology Program, he or she should pay close attention to the footnotes under "Freshman Year" on page 70.

The freshman year forest technology curriculum consists of general studies' courses which may be taken at any accredited four-year college, or agricultural and technical institute except Farmingdale or Alfred (although transfer credits from these schools are acceptable otherwise).

The second year of the curriculum is offered at the Faculty of Forestry's Forest Technology Program on the Wanakena Campus. Presented in a varied forest environment, the curriculum's emphasis is on fundamental forestry knowledge and applied field training as well as the relationships between forest technology and managerial needs. About fifty percent of the studies are devoted to field exercises, most of which are held on the School's forest. This managed forest, containing both hardwood and coniferous species, covers an area some 3½ miles long with widths varying up to 2¼ miles. On two sides, the forest is bounded by State Forest Preserve lands. The forest is also adjacent to several square miles of virgin timber within the Adirondack Forest Preserve. This excellent forest backdrop for the technology program provides a diverse laboratory for instructional purposes.

Since the Program is situated within a forest environment, some applicants may mistakenly believe that the forest technology program is one of forest lore and wilderness survival. It is, therefore, strongly emphasized that the forest technology curriculum demands high quality academic achievement. Students cannot complete the program without concentrated and consistent study. Classes are scheduled from 8 a.m. to 5 p.m., Monday through Friday, with classroom and laboratory or field time equally divided. The intensity of the program normally requires a minimum of 70 hours a week of evening and weekend study, daily classes, and laboratory/field exercises. Several short trips are made during the year in connection with courses in dendrology, silviculture, forest management, forest recreation, wildlife ecology, and surveying. Even though the Ranger School's major thrust is in forest technology, surveying is an additional and growing strength of the program.

LIFE AT WANAKENA

The Ranger School of the College of Environmental Science and Forestry is located on the banks of the Oswegatchie River near the hamlet of Wanakena, approximately 65 miles northeast of Watertown, and 35 miles west of Tupper Lake.

FOREST TECHNOLOGY CURRICULUM
(Associate in Applied Science Degree)

Freshman Year
(Completed at a college of the student's choice)

Course	*Credit Hours*
[1]General Biology	6-8
English (a technical report writing course is highly recommended)	6
[2]Math	4-6
Economics	3
[3]Electives	7
	30

[1]Courses selected may be in general biology, but at least one course in introductory botany is preferred.
[2]Competency in plane trigonometry and college algebra is required. If demonstrated, credits become electives. If students feel transfer to a baccalaureate program is a possibility, they would be well advised to take calculus.
[3]If a student feels transfer to a baccalaureate program is a possibility, general chemistry and physics should be taken as electives. Otherwise, courses in sociology, psychology, political science, geology, soils, accounting, business, computer science, etc. are desirable electives.

Senior Year
(Ranger School)

			Credit Hours
First Semester	FTC 200	Dendrology I	2
	FTC 202	Plane Surveying I	4
	FTC 204	Forest Mensuration and Statistics I	3½
	FTC 206	Forest Ecology	3
	FTC 207	Aerial Photogrammetry	2
	FTC 208	Allied Technologies	3
	FTC 213	Forest Protection I	2
	FTC 223	Graphics	1
			20½
Second Semester	FTC 203	Plane Surveying II	1
	FTC 205	Forest Mensuration and Statistics II	2
	FTC 209	Forest Roads	2
	FTC 211	Silviculture	2½
	FTC 214	Personnel Management	1½
	FTC 215	Timber Harvesting	2
	FTC 217	Forest Management	3½
	FTC 218	Forest Recreation	1½
	FTC 219	Elements of Wildlife Ecology	1½
	FTC 221	Soil and Water Measurements	1½
	FTC 227	Forest Protection II	2
	FTC 228	Structure and Growth of Trees	1½
	FTC 229 or FTC 230	Silviculture II **or** Plane Surveying III	2
			24½

A total of 75 credit hours is required. Upon satisfactory completion, an Associate of Applied Science (A.A.S.) degree of Forest Technology will be awarded.

The Program's buildings and its surrounding forest border on the river which flows directly into Cranberry Lake.

The main building consists of a central service unit with dormitory wings on either side. The central unit contains classrooms, laboratories, a student lounge, faculty offices, the library, a kitchen, dining room and 47 student rooms, each housing two students.

Faculty houses are nearby on the campus. Other buildings include a maintenance shop, garages, a sugar house, and storage buildings.

The close proximity of faculty offices and student quarters and the intensive fieldwork pattern enables students to consult easily and frequently with the faculty. The Program considers this traditional close student-faculty association to be of major benefit in its educational program.

A small library of approximately 1,500 volumes consists of highly specialized materials required for the teaching and study programs of the curriculum.

Students taking the second year of the forest technology curriculum at the Ranger School are required to live in the campus's dormitories. An exception may be made for married students who bring their families and rent their own private accommodations in the vicinity. Such accommodations are not plentiful. Each married student should make rental arrangements well in advance of the registration date.

The Ranger School does not maintain an infirmary, nor does it employ a physician or nurse. There are two physicians and a dentist as well as an excellent Community Hospital in nearby Star Lake, New York. In emergency, situations, the Program transports sick or injured students to the local physician of their choice or to the hospital. Health and accident policies for students are available through Syracuse University, and it is strongly suggested that the student consider such coverage before reporting to the Campus. Application forms are available through ESF's Office of Student Affairs and Educational Services.

Because of the comparatively isolated location of the Ranger School, a stock of books and supplies used in connection with the second year of the program is maintained on campus for sale to students.

During the first year of the program, College-enrolled students will be guided by the rules and regulations that govern attendance at their local campus. During the second year of the program, students will be guided by the general rules and regulations for College of Environmental Science and Forestry students and an additional set of Ranger School "house rules."

ADMISSION

Admission Requirements

Requirements for entrance into the forest technology curriculum require a minimum of high school units consisting of: English; history (social science); science (including biology); mathematics (two years college preparatory); and electives. Mechanical drawing, technical report writing, and computer science are suggested electives.

In addition to the academic requirements, the following must also be met by all applicants:

1. The applicant must be strongly motivated toward a career in field forestry.
2. The applicant must be willing and able to meet the physical requirements of the program which include pole and tree climbing, walking 2 to 6 miles through forest areas, often carrying 15-20 pounds of equipment, and using a wide array of hand tools and power equipment.
3. The applicant's parents (if the applicant is under 18 years of age) must be fully aware of the field nature of the study program, its rigorous study-work regime and supporting academic facilities.
4. A full medical examination report must be submitted.

Questions concerning any of these requirements should be referred to the Director of Admissions who may, under special circumstances, waive some of them.

Admission Procedures

The decision to admit any student to the Forest Technology Program rests solely with the College of Environmental Science and Forestry. Most openings in the program are filled by students who received conditional acceptances while still seniors in high school, contingent on successful completion of the first year of college. Remaining openings are filled by transfer students who have already attended college. Therefore, it is suggested that the potential forest technology student apply while still a high school senior.

Here is the procedure:

1. Seniors in high school must submit a regular SUNY freshman application for the College of Environmental Science and Forestry, using a Curriculum Code 620 (Forest Technology). These applicants should indicate entry date to be one year in advance of the current year.
2. Submit a regular application to that school selected for the first year of study, using Curriculum Code 620. It is important that students gain entry on their own for the first year of studies. The College will request information at a later date concerning what institution the student will be attending.

Effective fall 1990, a limited number of outstanding students will be admitted directly from high school. For further information, students should contact the Director of Admissions.

Transfer Students

Students with previous college experience, or students who are currently enrolled at another college, may apply for transfer. However, courses transferred for credit can be applied only to the freshman year course of studies, and they must be appropriate to those courses and comparable in subject matter, content, and level. All second year courses must be taken at the Ranger School, and, therefore, a student cannot transfer any previously earned credit toward the second year. Transfer applicants must submit a recent official copy of their college transcript and a list of courses they anticipate completing prior to enrollment.

EXPENSES

Cost of the first year will vary with the specific institution attended.

Estimated costs of the second year program at the Ranger School are as follows:

N.Y. Resident

Tuition	*Board, Room*	*Books, Supplies*
$1,350	Approx. $3,800	Approx. $1,000

Nonresident

Tuition	*Board, Room*	*Books, Supplies*
$3,200	Approx. $3,800	Approx. $1,000

An additional estimated expense of $200 will likely be incurred to cover the cost of laundry and clothing. There is also a $20 graduation fee, a $13 student activity fee, and a Camp Allegany fee of approximately $75, plus a $25 resident deposit and a $25 equipment deposit. The latter two fees are fully or partially refundable, depending on breakage charged to a student during the year.

FINANCIAL ASSISTANCE

Financial aid is available upon acceptance to the College of Environmental Science and Forestry. There are three basic loans, scholarships or grants, and part-time employment.

More detailed information on these financial aid opportunities can be found on pages 21-26 of this catalog and the publication *Financial Assistance at ESF.*

The student must file an application with the Office of Financial Aid at the Syracuse Campus and submit a *Family Financial Statement* to ACT, Iowa City, Iowa 52243.

PLACEMENT

The School assists in placement of graduates. The excellent reputation which the graduates of the Ranger School at Wanakena have developed in all types of forestry and surveying jobs greatly assists today's graduates to find employment. Employment is common with local, state and federal forestry, and land resource agencies, private forestry enterprises, and surveying firms. Positions most frequently filled by recent graduates include: state forest ranger, state forest technician, forest aide, industrial forest district supervisor, timber inventory specialist, timber sales supervisor, forest surveyor, forest engineering aide, forest protection technician, forest research technician, forest equipment salesman, tree service technician, and urban park ranger.

THE FACULTY OF LANDSCAPE ARCHITECTURE

RICHARD S. HAWKS, *Chairman*
331 Marshall Hall
(315) 470-6541

FACULTY

EMANUEL CARTER. *Professional Experience:* Project Planner, Ithaca, New York Department of Planning and Development; Recreation and Park Advisor, Pennsylvania Bureau of Recreation and Conservation; Associate Director-Planning, Chase Architectural Associates, Syracuse, New York; Principal Planner, Syracuse Department of Community Development; Adjunct Professor, Landscape Architecture Program, Cornell University; Adjunct Professor, Department of Geography, Syracuse University. *Fields of Specialization:* Urban Design, City and Regional Planning, Development Process, Planning and Design Theory.

GEORGE W. CURRY. *Professional Experience:* The Reimann-Buechner Partnership, Landscape Architects, Syracuse; The Curry-Paulo Partnership. Licensed Landscape Architect, New York State. *Fields of Specialization:* Site Planning, Urban Analysis and Design, Historic Preservation.

CLAUDE C. FREEMAN. *Professional Experience:* Russell Bailey and Associates, Landscape Architects and Planners; Alfred Obrist, Landscape Architect and Civil Engineer. *Fields of Specialization:* Site Design, Plant Materials, Graphics.

DAVID L. HANSELMAN. *Professional Experience:* Ohio Department of Education, Ohio Department of Natural Resources, Ohio State University. *Fields of Specialization:* Communications Strategies and Message Design, Non-Print Communications.

RICHARD S. HAWKS. *Professional Experience:* The Reimann-Buechner Partnership, EDAW, Inc., Cambridge Research Institute. Licensed Landscape Architect, New York State. *Fields of Specialization:* Regional Planning and Design, Natural Factors in Design, Facility Siting and Routing, Geographic Information Systems, University Campus Design and Planning, Energy Conservation.

ALLEN R. LEWIS. *Professional Experience:* Chief Community Planner, Bucks County Planning Commission, Doylestown, Pennsylvania. Member, American Institute of Certified Planners. *Fields of Specialization:* Community Land Use Planning; Planning Theory; System Dynamics; Modeling and Simulation.

FRANK L. MARAVIGLIA. *Professional Experience:* Senior High School Teacher; Business and Management Consultant; President, Centre of Applied Creativity, Baltimore, Maryland; Faculty, Annual Creative Problem Solving Institute, SUNY Buffalo, Organizational and Interpersonal Communication. *Fields of Specialization:* Technical Graphics, Creative Problem Solving, Education, Communication, Video, Management.

ANTHONY J. MILLER. *Professional Experience:* Clarke and Rapuano Inc., Consulting Landscape Architects and Engineers; Land Use Consultants, United Kingdom, Landscape Architects, Maurice Pickering Associates, United Kingdom, Jacques Miller Partnership, United Kingdom; Thames Landscape Group, United Kingdom; Brian Clouston and Partners, United Kingdom, Architects and Landscape Architects; Sir Denys Lasdun, Redhouse and Softley, United Kingdom, Architects; Thames Polytechnic, Dartford Kent, United Kingdom; Member Landscape Institute, United Kingdom; Examiner, Landscape Institute. *Fields of Specialization:* Site Design, Graphics, Plant Materials, Provision for Play, Video Simulation.

JAMES F. PALMER. *Professional Experience:* Research Associate, The Environmental Institute, University of Massachusetts; Associate Social Scientist and Resource Planner, Carlozzi, Sinto & Vilkilis, Inc.; College Planner, Kresge College, University of California at Santa Cruz. *Fields of Specialization:* Landscape Perception, Design Evaluation, Social Impact Assessment, Environment and Behavior Research Methods.

MATTHEW R. POTTEIGER. *Professional Experience:* Department of Landscape Architecture, Ball State University. *Fields of Specialization:* Cultural Landscape History, History of Landscape Architecture, Design Theory and Methodology.

ROBERT G. REIMANN. *Professional Experience:* City of Montreal, Department of Public Works, Parks and Playgrounds; Sargent, Webster, Crenshaw and Folly, Architects; James E. Glavin and Associates; Principal, The Reimann-Buechner Partnership; Director, Professional Practice Institute (ASLA); President, Landscape Architecture Foundation; Fellow, American Society of Landscape Architects; Member, ASLA Council on Education. *Fields of Specialization:* Environmental Design, Passive Energy Conservation, Site Planning and Design.

D. DAYTON REUTER. *Professional Experience:* School of Architecture and Environmental Design, University of Texas; Department of Landscape Architecture, University of Wisconsin, Madison; The Nature Conservancy, Wisconsin Chapter; Flad and Associates, Madison, Wisconsin; Environmental Design Group, Des Moines, Iowa; Division of Site Planning, Illinois Department of Conservation; Licensed Professional Landscape Architect, New York. *Fields of Specialization:* Ecology in Landscape Planning, Design, and Management (Wetlands); Computer Applications in Environmental Planning (GIS); Research Methodology.

S. SCOTT SHANNON. *Professional Experience:* Randolph Hlubik Associates, Riverside, California; Environmental Design & Research, Syracuse, New York; Licensed Landscape Architect, California and New York. *Fields of Specialization:* Site Planning and Design; Urban Analysis and Design; Historic Landscape Preservation Planning; Computer Applications.

KATHLEEN A. STRIBLEY. *Professional Experience:* Department of Landscape Architecture, The Ohio State University; Anderson-Lesniak and Associates, Inc.; Johnson, Johnson and Roy, Inc.; Dalton-Dalton-Little-Newport, Inc.; Member, Onondaga County Environmental Management Commission; Licensed Landscape Architect, Michigan and New York. *Fields of Specialization:* Design and Behavior; Public Participation; Urban Design, Parks and Recreation; Site Planning and Design.

Landscape Architecture

The alteration of the physical environment has been a product of human activity since the earliest times of human settlement. While environments of enduring beauty and vitality occasionally resulted, the history of environmental manipulation more often demonstrated degradation and abuse of the landscape. As the knowledge of natural and human processes has expanded, environmental change has been transformed over the centuries from the casual efforts of many to that requiring skilled individual effort and often demanding multidisciplinary attention.

The Faculty of Landscape Architecture offers two programs designed to educate students to contribute in varied ways to the wise use of land and landscape. Each degree program provides a basis for students to establish career directions in the profession landscape architecture. Both the Bachelor and Master of Landscape Architecture are offered.

BACHELOR OF LANDSCAPE ARCHITECTURE

The B.L.A. program is designed for those students desiring to enter the profession of landscape architecture either directly after completing the degree or after completing graduate school. This is a professional degree with an emphasis on the skills and knowledge required to qualify as a landscape architect. The degree is accredited by the American Society of Landscape Architects (ASLA). The B.L.A. degree is granted at the end of five years of study and requires the successful completion of 160 credit hours. Students enter into the third year of the program with a minimum of 62 lower division credit hours and follow the prescribed curriculum.

The B.L.A. program consists of a core of courses involving the basic principles and skills of landscape architecture design, land manipulation and engineering, applied ecology, and communications. Additionally, students are required to participate in an independent study semester of the Off-Campus Program during the fall semester of the fifth year. The Off-Campus Program requires students to cover tuition, books and materials, room and board, and travel cost to the location of study. The major objective of the B.L.A. program is the development of basic proficiency in design, engineering, and communication skills necessary for formal admission into the profession of landscape architecture.

When the prerequisite period of work experience has been completed, a person holding a B.L.A. degree may obtain a license to practice landscape architecture. At present, the State of New York requires those holding a five-year B.L.A. degree to complete a three-year period of internship in the field prior to applying for the licensing examination. Other states have varying requirements for obtaining a license.

As in any area of professional study, students seeking the B.L.A. degree are expected to demonstrate a high level of commitment and scholarship in their studies. This professional commitment is demonstrated by a desire to serve society in an objective, rational, and ethical manner.

Students receiving a B.L.A. degree have entered the profession as employees in public agencies or in private offices offering landscape architectural services. Also, B.L.A. graduates have entered graduate schools in landscape architecture, planning, urban design, regional design, and specific specialties including historic preservation, environmental policy, management, and research.

Bachelor of Landscape Architecture
Required Lower Division Courses

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
Written and Oral Communication Required credit hours in this area must be taken in courses dealing with English comprehension, the basic skills of grammar and composition, and public speaking.	6
Graphics A minimum of one course in engineering drawing, mechanical drawing, or architectural drafting is required.	3
Natural Sciences Required credit hours in this area must include a course in botany or plant biology. Additional hours should be taken from coursework in ecology,* physical geography, earth science, geology, or environmental geology.	6
Social Sciences Required credit hours in this area are to be taken from coursework in U.S. history, sociology, social psychology, social or cultural anthropology, political science, or economics.	3
Mathematics Required coverage of college trigonometry. Students with prior coverage in math who can demonstrate proficiency at time of admission may substitute elective hours for this prerequisite. More advanced math is desirable.	3
Computer Science Introduction to computers with basic application programs including word processing, spread sheets, and data base. Familiarity with micro computers and programming preferred.	3
Electives	38
TOTAL MINIMUM LOWER DIVISION CREDITS	62

*Can be waived at ESF if completed prior to transfer.

Prerequisites for Entry into the B.L.A. Degree Program

Because of the breadth of concern of the B.L.A. program, it is imperative that entering students prepare themselves with a broad range of lower division coursework. The environmental efforts with which the students will be involved require a strong background in both the natural and social sciences. In addition, prior skill development in graphics, mathematics, and computer science is required. The required prerequisite coursework described on page 73 must be met to prepare the entering student to engage the B.L.A. curriculum.

ELECTIVE GUIDELINES

Students planning to transfer to the Bachelor of Landscape Architecture Program should consider the following as guidelines in selecting their 38 credit hours

Bachelor of Landscape Architecture Curriculum

Third Year

			Credit Hours
First Semester	LSA 320	Introduction to Landscape Architecture and Planning	3
	LSA 326	Landscape Architectural Design Studio I	3
	CMN 382	Graphic Communication	3
	LSA 411	Natural Processes in Planning and Design	3
	EFB 320	General Ecology or Elective*	3
			15
Second Semester	LSA 327	Landscape Architecture Design Studio II	3
	LSA 330	Site Research and Analysis	2
	EIN 371	History of American Landscape Attitudes	3
	EIN 390	Social/Cultural Influences and Environmental Form	3
	ERE 306	Elements of Map and Air Photo Interpretation or Elective*	1
	ERE 308	Elements of Plane Surveying or Elective*	1
	WRT 404	Technical Writing	3
			16

Fourth Year

			Credit Hours
First Semester	LSA 422	Landscape Design Studio III	4
	LSA 433	Plant Materials	2
	LSA 434	Design Materials	1
	LSA 442	Site Grading	2
	LSA 443	Site Drainage Systems	1
	EIN 470	Art History or Elective*	3
	Elective		3
			16
Second Semester	LSA 423	Landscape Design Studio IV	4
	LSA 425	Orientation for Experiential Studio	2
	LSA 444	Vehicular Circulation Design	1
	LSA 445	Introduction to Structures	1
	EIN 451	Fundamentals of City and Regional Planning	3
	EIN 471	History of Landscape Architecture	3
	LIB 300	Library Research	1
	Elective		2
			17

Fifth Year

			Credit Hours
Summer	LSA 533	Plant Materials	2
First Semester	LSA 524	Experiential Landscape Design Studio V (Off-Campus Program)	16
Second Semester	LSA 522	Landscape Design Studio VI—Urban Design	4
	or		
	LSA 525	Landscape Design Studio VI—Site Design	4
	or		
	LSA 527	Landscape Design Studio VI—Regional Design	4
	LSA 545	Professional Practice Studio	3
	LSA 455	Professional Practice in Landscape Architecture	2
	Architecture Elective		3
	Elective		4
			16

*Elective only with prior coverage in required area.

A total of 160 credit hours is required to complete the B.L.A. degree.

NOTE: *A number of the courses listed in the B.L.A. curriculum are in the process of being revised. Upon revision, new course descriptions will be available after approval by the College of Environmental Science and Forestry Faculty.*

of electives. The following subject areas are considered *highly desirable*. Course areas marked (*) are required following transfer to the Program, but can be waived if completed prior to transferring. This will allow a student to take additional electives at ESF.

1. In addition to the required prerequisite credit hours listed, further subject coverage in written and oral communications, natural sciences, and social sciences as listed is recommended.
2. Art and Design
   Courses in this category should include art history* and studio art. Studio courses in drawing or three-dimensional design, sculpture, ceramics, and photography, are recommended.
3. Analytical Tools
   Courses in this category should include elementary plane surveying*, air photo interpretation*, or elementary physics. Additional work in computing technology is highly recommended, particularly in the realm of computer graphics and computer-assisted design (CAD).

Demonstration of academic excellence in environmental design and design graphics through submission of a portfolio is highly recommended as part of the admission's process to the B.L.A. program.

BLA/MLA Fast Track

The program is available to outstanding fourth-year Bachelor of Landscape Architecture students and provides the opportunity to receive both the Bachelor of Landscape Architecture and Master of Landscape Architecture degrees during a four-year period at the College. Students who apply must have a minimum 3.000 G.P.A. and are accepted into the program during the fall semester of the fourth-year of the Bachelor of Landscape Architecture program. During spring semester the transition begins between the Bachelor of Landscape Architecture and Master of Landscape Architecture curriculum requirements. Both degrees are awarded at the completion of 190 credit hours (62 lower division credit hours transfer to the College upon entering the Bachelor of Landscape Architecture third-year, 128 credit hours earned at the College).

MASTER OF LANDSCAPE ARCHITECTURE

The Master of Landscape Architecture degree is attractive to a wide range of students—those with nondesign degrees, those with architecture degrees who wish to broaden their professional skills, and to students with a previous undergraduate degree in landscape architecture who wish to enhance their academic background or gain specialized training in the field. With this range of students in mind, three major M.L.A. tracks are offered.

First Professional Degree

This master's degree program is open to those students who hold an undergraduate degree and meet the prerequisites for admission. The program is accredited by the American Society of Landscape Architects. The three-year course of study provides a strong foundation of design theory and process while emphasizing mastery of the skills associated with the practice of landscape architecture. Early courses focus on site planning and design within the neighborhood and community context, while advanced courses focus on broader neighborhood and community scales of physical design and planning.

The program requires cross-disciplinary study to prepare students to enter a variety of existing and emerging positions in the public and private sectors. The M.L.A. degree is granted upon the completion of 66 credit hours (57 graduate) in a prescribed curriculum.

FIRST PROFESSIONAL DEGREE COMPONENTS

The First Professional Degree has four components: a foundation year, a sequence of required core courses, a series of directed electives, and a final integrative experience. The core sequences of required coursework encompass design, skills, natural resources, scholarship and research, and directed electives. The first three semesters consist of required coursework which gradually broadens in focus to include complementary subjects such as community development and planning, landscape patterns and systems, and environment-behavior issues. In the fourth semester, students develop a proposal for their final integrative option working with their major professor and steering committee.

M.L.A. Program Sequence

The M.L.A. program is established as a three-year sequence of courses for students pursuing a first professional degree. The following schedule of courses illustrates a typical three-year program.

First Year		Credit Hours
[1]CMN 552	Graphic Communication	3
[3]LSA 320	Introduction to Landscape Architecture	A
LSA 433	Plant Materials	2
[1]LSA 600	Design Studio I—Introductory Design	4
LSA 601	Design Studio II—Site Design	4
LSA 611	Natural Factors Analysis	3
LSA 615	Introduction to Site Construction	3
[2]LSA 640	Research Methodology	3
LSA 671	History of Landscape Architecture	3
[2]LSA 697	Topics and Issues of Landscape Architecture	1
[4]Directed Electives		Varies
		26

Second Year		Credit Hours
LSA 620	Design Studio III—Advanced Site Design	4
LSA 621	Design Studio IV—Community Design and Planning	4
LSA 650	Behavioral Factors of Community Design	3
LSA 652	Community Development and Planning Process	3
LSA 654	Natural Systems and Landscape Patterns	3
LSA 655	Professional Practice	4
[2]LSA 799	Proposal for Thesis/Project or Internship	1
[4]Directed Electives		Varies
		22

Third Year		Credit Hours
[2]LSA 700	Design Studio V—Integrative Studio	4
[5]Integrative Option, Program Alternatives:		
[6]LSA 898	Professional Practice Internship	6-12
[6]LSA 899	Thesis/Project	6-12
[4]Directed Electives or Coursework Option		2-14
		18

[1]May be waived for students with undergraduate design degrees based on portfolio submission upon application.
[2]Also required for students who enter with advanced standing, such as previous B.L.A. degree.
[3]Audited (A) concurrent with LSA 697 Topics and Issues of Landscape Architecture.
[4]Directed electives are selected in consultation with the student's advisor to complete credit hour requirements. They are designed to augment the student's undergraduate preparation and may comprise the Integrative Coursework Option in the third year.
[5]The precise number of credit hours taken by a student in LSA 898, LSA 899, and in complementary directed electives, during a given semester is determined in consultation with the student's major professor.
[6]Students with previous undergraduate Landscape Architecture degrees are generally required to take LSA 899 Thesis/Project for their Integrative Option.

Three final integrative experiences are available: (1) thesis or project, (2) coursework, and (3) professional experience. A thesis consists of research which expands or clarifies knowledge related to the profession. A project consists of the critical application of professional knowledge and skills to a landscape architectural problem. The coursework alternative involves selected electives with an agreed upon focus. The professional experience is typically a semester-long internship with a public agency, private firm, or nonprofit institution. All final integrative options are completed with guidance from the student's major professor and steering committee.

M.L.A. for Students with Previous Bachelor's or Master of Architecture

Students with previous architecture degrees may enter a two-and-one-half year program requiring 56 credit hours. Additional advanced standing is determined individually through portfolio and transcript review. The curriculum for this program is similar to the three-year M.L.A. program, with exemptions in basic design, graphics, and professional practice based on prior professional degree credentials.

M.L.A. for Students with Accredited Landscape Architecture Degree

Students who have completed an accredited degree enter into a two-year M.L.A. degree track. Depending on the length and quality of previous professional experience, the degree may require from 30-42 credit hours. Students in this track are required to take Research Methods (LSA 640), Thesis/Project Proposal (LSA 799), Intregrative Studio (LSA 700), and Thesis/Project (LSA 899). Students plan an individual program with their major professor and steering committee.

CONCURRENT DEGREE OPPORTUNITIES

A variety of concurrent degree program opportunities exist for students wishing to develop a unique career track. Concurrent professional degrees in public administration, communication, or business management may be simultaneously pursued at Syracuse University. Students with a 3.500 grade point average may apply for joint degrees after one semester of study through the Dean of Instruction and Graduate Studies.

ROLE OF RESEARCH AND COMMUNITY SERVICE/SUPPORT FACILITIES

Research and community service play a significant role in the graduate program, primarily through funded projects and projects/theses. Research provides new knowledge and applications for the profession, and also enriches the curriculum, enhances faculty expertise, and develops students' skills in rigorous observation, clear thinking, and writing. Community-service projects often offer settings for design studio projects and individual student projects/theses.

The College library and several libraries on the Syracuse campus offer reference material to support study program. Landscape architecture facilities include adequate studio and office space. In addition, there are reproduction, model making, photographic, audio-visual, video, noise, solar, and visual simulation capabilities available. The College Computer Center has Macintosh and PS/2 microcomputer labs to support student instruction and individual work, and is fully interfaced with Syracuse University facilities. The microcomputer labs have CAD and video image processing for drawing production, 3-D modeling, and visual simulation, as well as Geographic Information Systems for landscape analysis and environmental planning. The College has a fully-equipped video recording studio, and a mapping science laboratory with remote sensing, photogeometry, GIS, and digital image processing capabilities.

Because of the important role of technologies in the future of landscape architecture, student use of computer and media capabilities is encouraged throughout the graduate program. Advanced students may specialize in applications and integration of these technologies.

REGIONAL AND COLLEGE CONTEXT

The Masters of Landscape Architecture is special in its location with the College of Environmental Science and Forestry. This provides the M.L.A. candidate with the opportunitty to draw upon information and knowledge in ecology, natural sciences, resource management, forestry, and many other related environmental disciplines. In addition, the relationship with Syracuse University provides an extensive intellectual as well as physical resource base.

The Syracuse area has the largest concentration of landscape architectural firms in the state, outside New York City. With a metropolitan population of nearly 500,000, the city provides many opportunities for urban studies. Also, the city's central location in upstate New York provides easy access to a rich variety of community design and planning contexts in nearby rural contexts, and throughout the northeastern United States and Canada.

GRADUATE ASSISTANTSHIPS

Students with associated professional degrees may be considered for a graduate assistantship (stipend and tuition scholarship) upon admission, depending upon qualifications and portfolio. Other students may apply for landscape architecture graduate assistantships after the first year of the First Professional Degree track. Assistantships may also be available with community service or research projects, and are awarded based upon qualifications.

PREREQUISITES AND ADMISSION REQUIREMENTS

Students seeking admission to the M.L.A. program may apply to enter in either the first or second year based on education and experience. Admission requires:

1. An undergraduate degree
2. Graduate Record Examination scores
3. Undergraduate transcript (3.000 average in junior and senior years generally required)*
4. Three letters of recommendation
5. A completed course is recommended in each of the six areas:
   a. botany, biology, or ecology
   b. geology, geomorphology, or earth science
   c. anthropology, psychology, or sociology
   d. computer applications
   e. drawing, drafting
   f. art or architecture history

Specific requirements may be waived based upon the complete application package and applicant's status.

Students seeking admission to the track for BArch/MArch or BLAs must additionally have:

6. Accredited design degree or equivalent; (3.000 average in major during the last two years)
7. Design portfolio
8. TOEFL scores required for all applicants whose native language is not English

NOTE: Applicants may be assessed as deficient in one or more areas deemed important to their admission to graduate study in the program. Courses taken to make up deficiencies (e.g., English for foreign students) may not count towards the credit hours required for the graduate degree.

Applications should be made prior to March 15 for the following fall. Visits to the College are encouraged and highly recommended.

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*Students with lower grade points may be admitted on a probationary status.

THE FACULTY OF PAPER SCIENCE AND ENGINEERING

LELAND R. SCHROEDER, *Chairman*
208 Walters Hall
(315) 470-6502

LELAND R. SCHROEDER, *Chairman* (Organic Chemistry, Pulping, Bleaching) BAMBACHT (Pulping, Papermaking, Paper Machine Operation), CROSBY (Paper Properties and Microscopy), DENCE (Organic Chemistry, Pulping, Bleaching), EUSUFZAI (Paper Properties and Sheet Morphology), FRANCIS (Chemical Engineering and Pulping), HOLM (Water and Air Pollution Abatement, Computer Simulation), HOLTZMAN (Papermaking, Paper Machine Operations), JELINEK (Computer Applications, Process Engineering, Thermodynamics), LAI (Organic Chemistry, Pulping), LUNER (Surface and Colloid Chemistry of Papermaking Systems), MARK (Mechanical Properties of Fibers and Paper), MARTON (Mechanical and High-Yield Pulping), RAMARO (Chemical Engineering, Instrumentation, Flow Phenomena, Process Control), THORPE (Fiber Physics, Paper Physics and Mechanics), UNBEHEND (Wet End Chemistry).

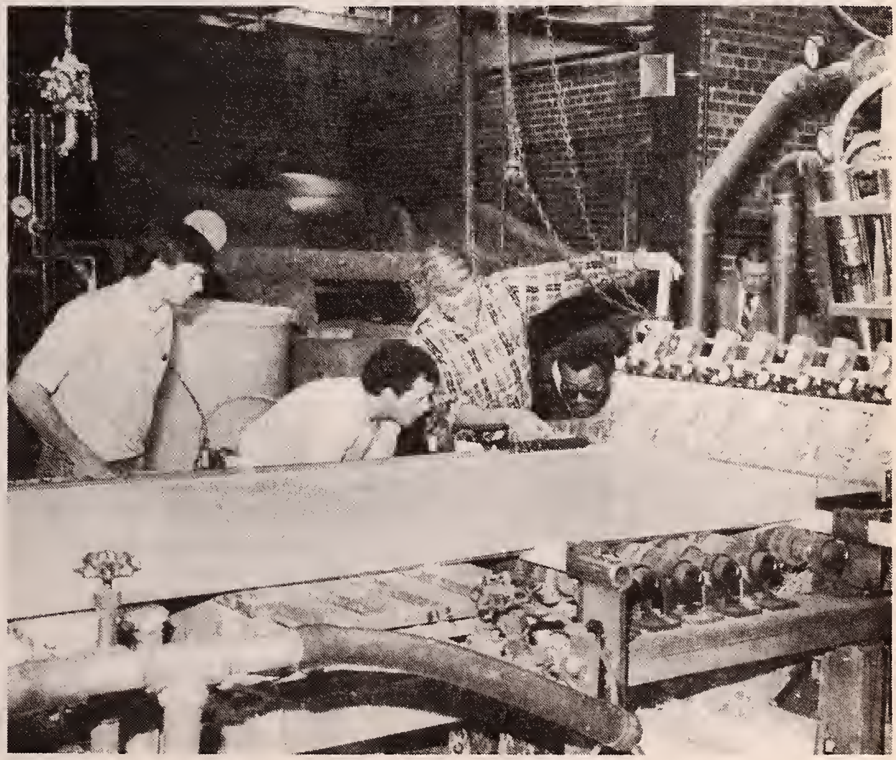
Paper Science and Engineering provides a broad base of study to prepare men and women for professional positions in the pulp and paper industry. This industry is the fifth largest in the nation and is very strong internationally. The College pioneered instruction for the pulp and paper and allied industries in 1920 with the formation of a paper science and engineering department which has maintained a singularly high position in this area of professional education. This program has a long-standing reputation for preparing graduates for rewarding positions as research chemists, process engineers, technical service representatives, managers, and many others. Graduates have advanced to positions of leadership in research, management, technical operations, sales, and many others in the pulp and paper as well as allied industries.

The program provides education in the physical sciences and chemical engineering, with specific emphasis on those aspects of these disciplines which relate to the manufacture of pulp and paper. This includes the chemistry and anatomy of wood, the conversion of wood to pulp and paper, and the chemistry and physics of paper and paper formation. All options include a basic core of courses in the physical sciences, chemical engineering, and specialized pulp and paper courses. The Science option offers great flexibility in the use of electives in a student-advisor designed program. The Engineering option extends the basic core to present a chemical engineering education fitted specifically to the pulp and paper industry. The Management minor includes instruction in the basics of management theory and applications.

Paper Science and Engineering is located in Walters Hall, which opened in 1969. This facility is devoted to education and research in the field of pulp and paper. In addition to a large number of special purpose laboratories and highly sophisticated scientific equipment, there is an experimental pulp and paper mill equipped with machinery and instrumentation for studies of pulping, pulp purification, reuse of secondary fibers, refining, paper additives, and papermaking. Equipment includes two complete paper machines, one 48-inch and one 12-inch, a pressurized refiner for mechanical pulping, and auxiliary equipment. An environmental engineering laboratory is designed to research various methods of paper recycling and waste treatment. This equipment, as well as the extensive chemical engineering laboratory, is employed for both education and research. Computer hardware and software is continually updated for teaching and research in process control and simulation.

Undergraduate Program

The curriculum is entered at the junior level by most students having an associate degree in engineering science, chemical technology, or science and mathematics. The engineering science associate degree is well suited to the new Engineering Option. Some latitude is available if the student's background includes most of the courses shown under "Lower Division Courses." The opportunity is also available to enter with fewer background courses if the student plans to extend his or her stay at the College. The student may elect to extend the time to complete the program by use of a cooperative work-study plan to help in financing the education as well as to gain experience to help in shaping a future career. All students are required to work for at least 12 weeks in the industry. The experience and financial return are valuable benefits from this requirement.



Lower Division Courses

Students entering through the freshman residency program will follow the curriculum described on page 39.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	Credit Hours
Botany or Biology with Laboratory	4
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory	8
Quantitative Analysis	3
Physics with Laboratory	8
Mathematics—Calculus I, II, III and/or Differential Equations	12
Computer Science	3
Economics	3
English	6
Engineering Drawing	1
Humanities or Social Science Electives	8
TOTAL MINIMUM LOWER DIVISION CREDITS	64

The Science Option

The Science Option consists mainly of chemistry and chemical engineering courses and specialized courses relating to the manufacture and use of pulp and paper products. The technical elective concentration allows the student to select a subject area of interest in which to specialize. This option prepares the student for careers in the technical, management, or technical representative areas with opportunities to extend interests in other directions.

SCIENCE OPTION

Upper Division Courses

Junior Year

			Credit Hours
First Semester	FCH 360	Physical Chemistry I	3
	FCH 572	Wood Chemistry II	3
	PSE 300	Introduction to Papermaking	3
	PSE 370	Principles of Mass and Energy Balance	3
	PSE 371	Fluid Mechanics	3
	PSE 496	Special Topics (Technical Writing)	2
	LIB 300	Library Research Methods	1
			18
Second Semester	FCH 361	Physical Chemistry II	3
	WPE 386	Structure and Properties of Wood	2
	WPE 390	Fiber Identification Laboratory	1
	PSE 301	Pulp and Paper Processes	3
	PSE 372	Heat Transfer	3
	*Electives		6
			18

SUMMER MILL EXPERIENCE:

Twelve weeks of full-time pulp and/or paper mill employment approved by Paper Science and Engineering—PSE 304 2

Senior Year

			Credit Hours
First Semester	PSE 461	Pulping Technology	3
	PSE 465	Paper Properties	4
	PSE 473	Mass Transfer	3
	PSE 477	Process Control	3
	PSE 491	Paper Science and Engineering Project I	1
	*Elective		3
			17
Second Semester	PSE 466	Paper Coating and Converting	2
	PSE 468	Papermaking Processes	3
	ERE 440	Water Pollution Engineering	3
	*Electives		6
			14

*At least 9 hours of electives must be selected from an *advisor-approved* sequence of technical courses. Examples of acceptable elective concentration areas are shown below.

Colloid and Surface Chemistry
Polymer Chemistry
Applied Mathematics
Management
Engineering Design
Independent Research Project
Instrumental Analysis
Pollution Abatement
Computer Modeling
Mechanics
Materials Science

A total minimum of 133 credit hours is required to complete the B.S. degree in the PSE science option.

The Science Option with a Management Minor

The Management Minor was developed from the Science Option by concentrating the electives in Management-specific courses. The student, therefore, combines a strong technical background with a firm base in management. The student should have completed a course in microeconomics and an accounting course prior to entering the junior year.

MANAGEMENT MINOR

Upper Division Courses

Junior Year			*Credit Hours*
First Semester	FCH 360	Physical Chemistry I	3
	FCH 572	Wood Chemistry II	3
	PSE 300	Introduction to Papermaking	3
	PSE 370	Principles of Mass and Energy Balance	3
	PSE 371	Fluid Mechanics	3
	PSE 496	Special Topics-Technical Writing	2
	LIB 300	Library Research Methods	1
			18
Second Semester	FCH 361	Physical Chemistry II	3
	WPE 386	Structure and Properties of Wood	2
	WPE 390	Fiber Identification Laboratory	1
	PSE 301	Pulp and Paper Processes	3
	PSE 372	Heat Transfer	3
	FOR 360	Principles of Management	3
	*Elective		3
			18

SUMMER MILL EXPERIENCE:
Twelve weeks of full-time pulp and/or paper mill employment approved by PSE.
PSE 304 2

Senior Year			*Credit Hours*
First Semester	PSE 461	Pulping Technology	3
	PSE 465	Paper Properties	4
	PSE 473	Mass Transfer	3
	PSE 477	Process Control	3
	PSE 491	Paper Science and Engineering Project I	1
	*Elective		3
			17
Second Semester	PSE 456	Management in the Paper Industry	3
	PSE 466	Paper Coating and Converting	2
	PSE 468	Papermaking Processes	3
	ERE 440	Water Pollution Engineering	3
	*Elective		3
			14

*At least 9 hours of electives must be used to complete the following courses: FIN 355 Money and Banking, LPP 255 Introduction to the Legal System, and either MAR 355 Marketing and Society or PIR 355 Introduction to Personnel.

A total minimum of 133 credit hours is required to complete the B.S. degree in PSE with a management minor.

The Engineering Option

The Engineering Option has been designed to provide an accreditable chemical engineering education for the student preparing for an engineering career in the pulp and paper industry. The courses are designed to present the principles of engineering with the disciplines and examples selected especially for the pulp and paper industry. Courses have been added in the areas of basic principles in electricity, statics and dynamics, and mechanics, as well as thermodynamics and design. The graduate is prepared to move into assignments in the engineering field and advance quickly to positions of responsibility in the analysis and design of processes and equipment. The Engineering Option is especially flexible in terms of extending the course of study to fit individual backgrounds.

The student, who enters the junior year with all lower division requirements in place, will need to make the choice between the Engineering and Science Options prior to entering the fall semester of the senior year.

ENGINEERING OPTION

Upper Division Courses

Junior Year

			Credit Hours
First Semester	FCH 360	Physical Chemistry I	3
	FCH 572	Wood Chemistry II	3
	PSE 300	Introduction to Papermaking	3
	PSE 370	Principles of Mass and Energy Balance	3
	PSE 371	Fluid Mechanics	3
	PSE 496	Special Topics (Technical Writing)	2
	LIB 300	Library Research Methods	1
			18
Second Semester	FCH 361	Physical Chemistry II	3
	WPE 386	Structure and Properties of Wood	2
	WPE 390	Fiber Identification Laboratory	1
	PSE 301	Pulp and Paper Processes	3
	PSE 372	Heat Transfer	3
	APM 395	Probability and Statistics for Engineers	3
			15

SUMMER MILL EXPERIENCE:

Twelve weeks of full-time pulp and/or paper mill employment approved by Paper Science and Engineering—PSE 304 2

Senior Year

			Credit Hours
First Semester	PSE 361	Engineering Thermodynamics	3
	PSE 465	Paper Properties	4
	PSE 473	Mass Transfer	3
	MEE 225	Statics and Dynamics	4
	ELE 221	Electrical Network Theory	3
			17
Second Semester	PSE 466	Paper Coating and Converting	2
	PSE 468	Papermaking Processes	3
	PSE 480	Process and Plant Design I: Analysis	3
	ERE 440	Water Pollution Engineering	3
	CIE 325	Mechanics of Deformable Bodies	3
	ELE 394	Electrical Network Laboratory	1
			15

Fifth Year

			Credit Hours
First Semester	PSE 461	Pulping Technology	3
	PSE 477	Process Control	3
	PSE 481	Process and Plant Design II: Synthesis	3
	*Elective		3
			12

A total minimum of 143 credit hours is required to complete the B.S. degree in the PSE engineering option.

Graduate Opportunities

The faculty participates in graduate education leading to the Master of Science and Doctor of Philosophy degrees through the program in Environmental and Resource Engineering. See page 42 for more information on this program.

Graduate studies reflect the strong trend toward diversification in the industry and offer opportunities for study in a variety of subjects related to the manufacture of pulp and paper. Individual study programs are designed to meet specific personal needs.

An important component of the graduate program is thesis research under direction of a graduate advisor. Much of this research is carried out under the auspices of one of the outstanding research facilities of the world, the Empire State Paper Research Institute (ESPRI), an integral part of the faculty. Its research activities aim to generate new information regarding the fundamentals, the science, the engineering and the technology of the papermaking process, utilizing advanced techniques such as computer simulation, electron microscopy, specialized spectrophotometry, nuclear magnetic and electron spin resonance and nuclear tracer methods. Recent work has been directed to fundamental investigations of pulping, bleaching, additives, paper recycling, effluent disposal, the papermaking process, the properties of paper, reactions of wood components during mechanical and chemical treatments, the structure of wood and wood fibers, evaporation, fluid dynamics, heat transfer, and chemical recovery. Pilot scale equipment in Walters Hall is often used as an integral part of these research programs.

Many research projects are carried out in cooperation with other College faculties. Examples of such projects include a wide-ranging study of toxicity of paper industry effluents in cooperation with the Faculty of Environmental and Forest Biology, and a cooperative project on the theoretical and experimental analysis of the mechanical properties of fiber and paper with the Department of Aerospace and Mechanical Engineering at Syracuse University. Cooperative studies enable access to the latest equipment in the computer field, including "super" computers.

The faculty enjoys excellent external support in the form of graduate fellowships and grants from ESPRI, the Syracuse Pulp and Paper Foundation, and other industry sources, as well as a number of government granting agencies.

THE FACULTY OF WOOD PRODUCTS ENGINEERING

LEONARD A. SMITH, *Chairman*
403 Baker Laboratory
(315) 470-6880

LEONARD A. SMITH, *Chairman* (Adhesives, Coatings, Wood-based Composites) COTÉ (Cellular Ultrastructure, Light and Electron Microscopy), DAVIDSON (Physical Properties of Wood), HANNA (Ultrastructure and Microscopy), HUSSEIN (Structural Engineering, CAD), KEULER (Construction Estimating, Safety, Codes and Zoning, HVAC), KYANKA (Construction, Applied Mechanics, Engineering Design), MEYER (Wood Properties, Anatomy), SALGADO (Construction Management, Cost Engineering, Scheduling), W. SMITH (Wood Preservation and Seasoning).

Undergraduate Program

The Wood Products Engineering Program prepares students for a wide variety of professional occupations in heavy construction or in the use of wood as a material. These interests are presented in two curriculum options: Construction and Wood Science and Technology. Both options have courses taken at Syracuse University and ESF which permit tailoring the program to complement the education from a wide variety of two-year preparatory programs.

A modern array of personal computers is available in Wood Products Engineering and ESF for performing calculations, graphics, and word processing. An extensive collection of software programs is available to students for performing classroom and laboratory assignments. Those who desire to learn more about these software programs are given individual instruction so that they may obtain greater knowledge and experience to offer potential employers.

Lower Division Courses

To enter either option at the junior level, transferring students must have acceptable college credit of 62 credit hours from five course areas shown below:

Course Area	*Credit Hours*
Mathematics/Sciences	Up to 18
Calculus I and II, Chemistry with lab and Physics I with lab are required.*	
Written and Oral Communication	6-9
English Comprehension, Composition, Public Speaking, and Technical Writing	
Social Sciences	3-9
For example: Economics, Sociology, Psychology, Ethics, and Human Relations	
Liberal Arts and Sciences (other)	Up to 15
For example: Philosophy, Art, History, Language, Literature, Political Science, Geology, Biology, Computer Science, and Statistics	
Professional Studies	Up to 40
For example: Design, Technology, Management, Graphics	
FULL JUNIOR STATUS	62

*For students who have completed Calculus I and Physics I, all requirements for the B.S. degree can be fulfilled in four semesters (Calculus II and Chemistry are taken during the first year at ESF in place of elective courses). For students who lack Calculus I and Physics I, all requirements for the B.S. degree, including calculus, chemistry, and physics, can be fulfilled while a student at ESF in five semesters with an entry date of September or January.

Construction Option

The Construction Option prepares students for careers in the construction industry. The program combines a group of required and emphasis courses given by Engineering faculty in the fields of Construction Engineering and Management, with unique strengths in Wood Engineering. In-depth study in all areas pertinent to the engineering and management of projects gives students a comprehensive understanding of the construction process.

Study areas include project management, construction methods and equipment, estimating, planning and scheduling, construction contracts and specifications, construction materials, cost engineering, wood engineering and building systems and codes. Electives in business and technical areas are also available.

Graduates are well prepared across a broad range of careers in the very challenging and dynamic field of construction. Positions held by alumni include:

- General Contractor
- Project Manager
- Project Engineer
- Planning/Scheduling Engineer
- Cost Engineer
- Estimator
- *Timber Engineer
- Field Superintendent
- Truss Design Engineer
- Construction Inspector

*Those students having a strong academic preparation in calculus, physics, and engineering sciences may have joint or sequential registration in engineering curricula registered for professional licensure.

CONSTRUCTION OPTION

Upper Division Courses

4-Semester Sequence

			Credit Hours
Fall Semester	ERE 371	Surveying	3
	WPE 342	Light Construction	3
	WPE 361	Engineering Mechanics-Statics	3
	WPE 387	Wood Structure and Properties	3
	Elective		3
			15
Spring Semester	APM 391	Statistical Analysis	3
	ERE 362	Mechanics of Materials	3
	ERE 364	Engineering Materials	3
	WPE 343	Construction Estimating	3
	WPE 350	Construction Methods and Equipment	3
	General Education Elective		3
			18
	Field Trip: WPE 399		1
Fall Semester	CIE 337	Soil Mechanics I	3
	FEG 410	Structures	4
	WPE 453	Construction Planning and Scheduling	3
	WPE 497	Senior Seminar	2
	General Education/Technical Elective		3
			15
Spring Semester	WPE 454	Construction Project Management	3
	WPE 455	Construction Contract and Specifications	3
	Construction Technical Elective		3
	General Education Elective		3
	Wood Technical Elective		3
			15

5-Semester Sequence (September Entry)

Fall Semester	MAT 295	Calculus I	3
	PHY 103	Physics I	4
	WPE 342	Light Construction	3
	WPE 387	Wood Structure and Properties	3
	General Education Elective		3
			16
Spring Semester	APM 391	Statistical Analysis	3
	MAT 296	Calculus II	3
	WPE 343	Construction Estimating	3
	WPE 350	Construction Methods and Equipment	3
	General Education Elective/Computer		3
			15
	Field Trip: WPE 399		1
Fall Semester	CHE 106	Chemistry	4
	ERE 371	Surveying	3
	ERE 496	Construction Planning and Scheduling	3
	WPE 361	Engineering Mechanics-Statics	3
	General Education Elective		3
			16
Spring Semester	ERE 362	Mechanics of Materials	3
	ERE 364	Engineering Materials	3
	WPE 454	Construction Project Management	3
	WPE 455	Construction Contract and Specifications	3
	Wood Technical Elective		3
			15
Fall Semester	CIE 337	Soil Mechanics I	3
	FEG 410	Structures	4
	WPE 497	Senior Seminar	2
	Construction Technical Elective		3
	Elective		3
			15

A total of 126 credit hours is required to complete the B.S. degree in Wood Products Engineering with the Construction Option (4-semester sequence).

CONSTRUCTION OPTION

Upper Division Courses

5-Semester Sequence (January Entry)

Spring Semester	MAT 295	Calculus I	3
	PHY 211	General Physics	4
	WPE 350	Construction Methods and Equipment	3
	Construction Technical Elective		3
	General Education Elective		3
			16
Fall Semester	CHE 106	Chemistry	4
	ERE 371	Surveying/Light Construction	3
	MAT 296	Calculus II	3
	WPE 361	Engineering Mechanics-Statics	3
	WPE 387	Wood Structure and Properties	3
			16
Spring Semester	ERE 362	Mechanics of Materials	3
	ERE 364	Engineering Materials	3
	WPE 343	Construction Estimating	3
	Construction Technical Elective		3
	General Education Elective		3
			15
	Field Trip: WPE 399		1
Fall Semester	CIE 337	Soil Mechanics I	3
	FEG 410	Structures	4
	WPE 453	Construction Planning and Scheduling	3
	WPE 497	Senior Seminar	2
	General Education Elective		3
			15
Spring Semester	WPE 454	Construction Project Management	3
	WPE 455	Construction Contracts and Specifications	3
	Construction Technical Elective		3
	General Education Elective		3
	Wood Technical Elective		3
			15

Construction Technical Electives:
CIE 332 Structures II
CIE 338 Soil Mechanics II
WPE 330 Building Codes and Zoning Practices
WPE 332 Mechanical and Electrical Equipment
WPE 335 Cost Engineering
WPE 404 Design of Wood Structure
WPE 413 Computer-Aided Senior Project
WPE 414 Computer Applications in Engineering

General Education Electives:
FOR 205 Introduction to Macroeconomics
FOR 206 Introduction to Microeconomics
FOR 461 Management Models
WPE 401 Creative Approaches to Management

Wood Technical Electives:
WPE 326 Fluid Treatments
WPE 404 Design of Wood Structural Elements
WPE 420 Adhesives, Sealants and Coatings
WPE 422 Composite Materials

Wood Science and Technology Option

Students electing this option have two elective concentrations from which to choose—marketing/management or science. Both build upon a core set of courses designed to develop a comprehensive knowledge and understanding of wood and wood products. Students meet individually with their faculty advisors to discuss their career goals and prepare a study plan. "Emphasis courses" shown in the program are courses selected from marketing, management, and/or science courses. Students have the privilege of taking courses at Syracuse University as a registered ESF student.

Students choosing marketing/management will select courses from Syracuse University's School of Management and from ESF. They may elect to gain a broad knowledge or focus in one or two of the following areas:

Accounting
Economics
Finance
Management
Contract Law
Marketing
Personnel Relations
Operations Management

Those students who choose *science* will select courses in the biological, chemical, and/or physical science courses offered at ESF and Syracuse University. Advanced courses in wood science and wood technology are also available. Some emphasis courses are:

Tropical Timbers
Wood Chemistry
Physiology and Pathology
Computer Applications
Independent Research

Graduates have used their educational background in business and technology to obtain positions in the wood industry and industries serving the wood industry (adhesive, coating manufacturers), or other industries. Knowing the principles of business and technology, graduates are effective communicators with people having financial responsibilities of the corporation and with people having design and production responsibilities.

Some areas of employment are: marketing, manufacturing, technical service, and product development. A special knowledge of the material properties of wood and the suitability of specific wood species for use in various products enable a graduate with marketing emphasis to assist

WOOD SCIENCE AND TECHNOLOGY

Upper Division Courses

Junior Year

			Credit Hours
First Semester	EFB 305	Dendrology	2
	WPE 361	Engineering Mechanics-Statics	3
	WPE 387	Wood Structure and Properties	3
	WPE 388	Wood & Fiber Identification Laboratory	2
		Elective Courses	6
			16
Second Semester	WPE 326	Fluid Treatments	2
	WPE 327	Fluid Treatments Laboratory	1
	ERE 362	Mechanics of Materials	3
		Emphasis Courses	6
		Statistical Analysis	3
			15
	Field Trip:	WPE 399	1

Senior Year

			Credit Hours
First Semester	WPE 420	Adhesives, Sealants, and Coatings	3
	WPE 497	Senior Seminar	2
		Emphasis Courses	6
		Elective Course	3
			14
Second Semester	WPE 422	Composite Materials	3
	FOR 404	Economics of Wood-Using Industries	3
	WPE 404	Design of Wood Structural Elements	3
		Emphasis Courses	6
		Elective Course	3
			18
		TOTAL MINIMUM UPPER DIVISION CREDITS	64

Emphasis courses—Courses in marketing/management or in science.

A total of 126 credit hours is required to complete the B.S. degree in Wood Products Engineering with the Wood Science and Technology Option.

a customer in selection of the right wood product for the intended end use or makes possible the procurement of the best wood raw material for manufacturing operations. These situations include considering the correct species of wood, treatments to prolong the useful life of a wood product, or selection of the most suitable manufactured product, such as medium density fiberboard or plywood for a specific application.

Wood science deals with materials science and engineering to increase the efficiency of wood use, apply existing or new knowledge to wood product manufacture or utilization, or to do the research and development required for the new products, processes, and treatments. Job titles of recent graduates include:

- Applications Engineer
- Product Development Engineer
- Quality Control Engineer
- Plant Engineer
- Production Supervisor
- Wood Products Technologist

Some students desire to continue their formal education by pursuing masters' degrees. Students who have achieved a good grade point average are well prepared to pursue Master of Business Administration or Master of Science degree programs.

Graduate Facilities

Through the program in Environmental and Resource Engineering, the Faculty participates in graduate education leading to the Master of Science and Doctor of Philosophy degrees.

The philosophy of the graduate program is to instill in students an understanding of the behavior of wood and composite materials made from wood. Areas of research are described in the section on Division of Engineering (p. 41). Persons with varied backgrounds such as wood technology, engineering, or biology can pursue a course of study either for breadth or for depth, as the professional goals of the student dictate.

Research in progress in ultrastructure includes light and video microscopy of wood fracture to elucidate wood fracture mechanism, strain field analysis of wood and paper, cellulose synthesis and the cytoskeleton, and intracellular communication (plasmadesmata, gap junctions). Current projects in the field of mechanics are focused on the dynamic and static response of solid wood, wood composite materials and wood structures to various load conditions, and modeling of the response of wood structures to loads. Other active research areas include biodegradation, properties of juvenile wood, and the growth-wood quality relationships.

Laboratory facilities include a mechanical testing laboratory with a wide range of testing machines, electronic data acquisition facilities, shaker table and frequency analyzers, and complete wood processing facilities including a sawmill, plywood mill, dry kilns, and wood preservation equipment. One of the largest foreign wood collections in the United States is located at ESF and is used for graduate research and to support the program of the Tropical Timber Information Center (TTIC).

A complete microscopy laboratory, containing transmission electron microscopes, scanning electron microscope with energy dispersive x-ray analysis and particulate analysis accessories, a wide variety of light and video microscopes, and related equipment give the student the ability to relate macroscopic behavior to anatomical characteristics of the products being investigated. Extensive equipment for chemical analysis and nuclear chemical techniques also serve the research program.

Course Offerings

COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY COURSE DESCRIPTIONS

The courses offered by the College are grouped by general subject areas, and the number of credit hours appears after the course title. A credit hour means one recitation (or lecture) hour per week. Three laboratory hours are equivalent to one lecture hour.

The semester(s) after each course indicates when it is normally offered. The College reserves the right to alter the scheduled offering of a course when its enrollment is too small, or when there is no qualified faculty member available to teach it.

Courses listed in this catalog are subject to change through normal academic channels. New courses, course deletions, and changes in courses are initiated by the cognizant Faculties or programs, approved by the appropriate academic dean, faculty committee, and the college faculty.

Course Numbering System

Code Levels:

100-499 Undergraduate courses for which no graduate credit may be given.

500-599 Graduate courses designed expressly for areas of specialization in post-baccalaureate programs or in the professional program leading to the Bachelor of Landscape Architecture. Qualified undergraduate students may enroll by permission of the instructor.

600-699 Graduate courses designed expressly for advanced levels of specialization. Undergraduate students with a cumulative grade point average of 3.000 or better may enroll in these courses with an approved petition.

700-999 Advanced graduate level courses for which no undergraduate students may register.

Shared resources courses, designated as 400/500 or 400/600, are designed when the topic coverage of both courses is the same. Separate course syllabuses are developed expressly differentiating the requirements and evaluative criteria between the undergraduate course and the graduate course.

General Subject Areas

APM—APPLIED MATHEMATICS

APM 205. Topics in Integral Calculus (3)
Three hours of lecture and recitation covering the fundamentals of integral calculus and associated topics of analytic geometry. Fall.
Prerequisite: Calculus I.

APM 360. Introduction to Computer Programming (3)
The basic course in computer programming offered by the College. It is intended to provide the student with the skill and understanding needed to utilize digital computer languages for problem solving. The course will cover instruction in Fortran and an introduction to APL; cursory use of operating systems; and some background material in general hardware/software designs. Fall and Spring.

APM 391. Introduction to Probability and Statistics (3)
Elementary probability including permutations, combinations, and other counting formulae, and basic statistical inference, including point estimation, confidence intervals, and hypothesis testing for one or two population means or proportions.

APM 395. Probability and Statistics for Engineers (3)
Elementary probability including permutations, combinations, and other counting formulae, and basic statistical inference, including point estimation, confidence intervals, and hypothesis testing for one or two population means or proportions.
Prerequisite: Calculus through integral calculus.

APM 492. Forest Biometrics (3)
Two hours of lecture, three hours of laboratory. Analysis of variance including nested and cross-classification. Matrix approach to multiple linear regression and weighted least squares. Nonlinear regression. Sampling methods and design. Applications to forestry problems. Fall.
Prerequisite: APM 391 or equivalent.

APM 500. Introduction to Computer Programming for Graduate Students (3)
A basic course in computer usage. Provides the skill needed to utilize digital computer languages for problem solving. Includes a study of Fortran with a discussion of APL and Assembly Language. Other topics include representation of information, management of files, error control, operational systems and job control.

APM 510. Statistical Analysis (3)
Two hours of lecture and three hours of laboratory. A treatment of statistical inference, including paired design, group design, linear regression and correlation, one way analysis of variance and some applications of chi-square. Calculation of statistics, test of hypotheses and proper interpretation of calculated statistics. Fall.

APM 620. Analysis of Variance (3)
Three hours of lecture and recitation and three hours of laboratory. Multiway classifications in the analysis of variance, with emphasis on the development of models, including randomized blocks, latin squares, split plots, and factorial designs with fixed effects, random effects, and mixed effects; multiple and partial regression and correlation (including curvilinear), using matrix methods; analysis of covariance. Fall.
Prerequisites: Graduate standing and an introductory course in statistics covering material through the one-way analysis of variance.

APM 625. Introduction to Sampling Techniques (3)
Two hours of lecture and three hours of laboratory. Introduction to the scientific basis of sampling: selecting an appropriate sampling unit; choosing an efficient design; calculating sampling error; determining a sample size to meet stated objectives. Fall.
Prerequisite: APM 391 or equivalent.

APM 630. Regression Techniques with Applications to Forestry (3)
Two one and one-half hours of lecture. Review of matrix algebra, probability theory and statistical methods. Basic concepts in regression analysis. Classical linear regression model. Least and weighted least squares method. Dummy variables and their uses in regression and covariance analysis. Applications to problems of statistical prediction and estimation from the field of forestry in general and forest mensuration and inventory in particular. Fall.
Prerequisite: APM 391 or equivalent.

APM 635. Multivariate Statistical Methods (3)
Estimation and inference for the multivariate normal distribution. Multivariate analysis of variances, factor analysis, principal components analysis, canonical correlation, discriminate analysis, cluster analysis. Spring.
Prerequisite: One semester of statistics.

APM 650. Operations Research (3)
Two one and one-half hours of lectures. Deterministic and Stochastic Operations Research models applicable to managerial problems. Linear programming, transportation and allocation models, goal programming, dynamic programming, network analysis, and simulation techniques. Spring.
Prerequisites: APM 391 and MAT 227 or equivalent, or permission of the instructor.

APM 696. Special Topics in Quantitative Methods (1-3)
Experimental and developmental courses in areas of quantitative methods not covered in regularly scheduled courses. A course syllabus will be available to students and faculty advisors prior to registration.

CMN—COMMUNICATIONS (LANDSCAPE ARCHITECTURE)

(See also courses listed below under EIN and LSA.)

CMN 310. Computer Applications for Professional Communications (3)
Three hours of lecture and discussion. An introductory course in environmental data sources and computer applications useful for information processing and communication. Fall and spring.

CMN 380. Technical Drawing I (1)
One three-hour drafting room period. Elements of perspective, isometric, oblique, and orthographic projection. Practice in freehand and instrument drawing. Fall.

CMN 381. Technical Drawing II (2)
Two three-hour drafting room periods. Elements of perspective, isometric, oblique, and orthographic projection. Practical applications of these principles in machine and architectural drawing, including piping and electrical drawings. Spring.

CMN 382. Graphic Communication (3)
Two three-hour studios and one one-hour lecture per week. Studio time devoted to demonstrations, exercises, and projects. Focusing on sketching, drafting, drawing construction and rendering techniques used in the landscape architecture field. Emphasis on skill development, and use of graphics in the design process. Drawings, examinations, and actual project constitute basis for grades. Fall.

CMN 410. Writing for Environmental Professionals (3)
Three hours of lecture and discussion. Principles and practice of writing skills required of environmental professionals. Develop proficiency in determining the purpose of a document; analyzing the audience; selecting, developing, and organizing the information in an appropriate design; and writing clearly, precisely, and effectively. Writing assignments are made weekly; rewriting is routinely required. Fall and spring.
Prerequisite: Satisfactory completion of a college-level course in basic writing skills.

CMN 530. Environmental Communications Studio (2)
Three-hour studio and one-hour discussion. For seniors and graduate students, this course offers the opportunity for students to apply communications theory and strategies through the planning, production, and display of media projects developed around the student's area of professional interest. Enrollment limited to 20 students. Fall.
Prerequisite: CMN 531 or permission of the instructor.

CMN 531. Environmental Communications (3)
Three hours of lecture/discussion. An introductory course for seniors and graduate students which presents techniques and processes in education and communications applicable in environmental science, management, planning, and design. Topics incude basic teaching, learning and communications theory and strategy, working with the press, electronic media, gaming and simulation, public address techniques, slide/tape production and use, film production and use. Spring.

CMN 552. Graphic Communication (3)
Two three-hour studios and one one-hour lecture per week. Studio time devoted to demonstrations, exercises and projects focusing on sketching, drafting, drawing construction and rendering techniques used in the landscape architecture field. Introduction to drawing reproduction and technologies. Emphasis on skill development, use of graphics in the design process. Drawings, examinations, and a final project constitute basis for grades. Fall.
Prerequisite: M.L.A. status or permission of the instructor.

CMN 637. Environmental Communications Project (1-3)
This course is designed to give graduate students an opportunity to work as a team in identifying, developing, administering, and evaluating a communications project related to an environmental issue. Typically, a workshop or shortcourse will be developed and offered for some targeted public through the School of Continuing Education. The nature of the topic and format of the project will be determined according to experience background of students enrolled. Task responsibilities and time commitments are correlated with number of hours for which student has registered. Spring.

CMN 682. Video Communications (3)
Three hours of studio plus lecture. This course will provide students with instruction and experience in the skills necessary to provide video tape programs. Each student will prepare and develop a video script for production of a program on an assigned topic. Completed programs will be tested and evaluated. Class size is limited. Fall and Spring.
Prerequisite: Permission of the instructor.

CMN 738. Environmental Education Programs of Agencies and Institutions (1-3)
One three-hour seminar session. An analysis of contemporary environmental education objectives, methodologies, and philosophies employed by various public and private institutions. Attendance, readings, and short paper required for one-hour credit. For two or three hours credit, an individual investigation of the environmental education and communications activity of an agency or organization is also required. Fall.

EFB—ENVIRONMENTAL AND FOREST BIOLOGY

The Faculty of Environmental and Forest Biology offers a diverse array of courses at both undergraduate and graduate levels. Based on student interest, curricula can be designed to accommodate a degree of specialization in one or more subdisciplines of biology. In the following list, courses numbered from ( )00 - ( )25 (at each level) are General Biology offerings; those from ( )26 - ( )50 are Plant Sciences, and those from ( )51 - ( )95 are Animal Science courses.

NOTE: All EFB courses of 300 level and above require a minimum prerequisite of one year of college biology or equivalent. A course at an appropriate level may be taken with permission of the instructor.

EFB 226. General Botany (4)
Three hours of lecture and three-hour laboratory. An introduction to plant biology with special emphasis on the structure and function of the green plant. Fall.

EFB 285. Principles of Zoology (4)
An introduction to the study of vertebrate and invertebrate animals,

including reproduction, development, heredity, physiology, form and function, diversity, evolution, and behavior. An integrated laboratory and lecture course that introduces processes of scientific inquiry and provides a basis for understanding the natural world. The course provides the fundamental background for advanced or specialized courses, e.g., in animal physiology, anatomy, taxonomy, ecology, behavior, and fisheries/wildlife sciences.

EFB 303. Introductory Environmental Microbiology (4)
Three hours of lecture and three hours of laboratory. An introduction to the biology of microorganisms and viruses and a study of their interactions with other microbes and macroorganisms. Fall.

EFB 310. Evolutionary and Systematic Biology (3)
Three hours of lecture. Exploration of the core concepts of evolutionary and systematic biology to better understand organic diversity. Includes study of evolution's causal factors (mutation, migration, drift, and natural selection) and results (microevolution, differentiation, speciation and macroevolution) as well as the principles that allow classification of living organisms and reconstruction of evolutionary histories. Examples are drawn from plants, animals, and microorganisms. Spring.
Prerequisities: Courses in general biology, zoology, botany, ecology.

EFB 320. General Ecology (3)
Two hours of lecture, three hours of field trips during the first half of the semester. Introduction to ecosystem ecology stressing the dynamic interrelationships of plant and animal communities with their environments, ecological factors, energy flow and trophic levels in natural communities, plant responses and animal behavior, population dynamics, biogeography, and representative ecosystems. The ecological impact of man is reviewed. Fall.

EFB 325. Cell Physiology (3)
Three hours of lecture. Introduction to the dynamics of living systems with emphasis on the universality of the biological world. Spring.
Prerequisite: One semester of organic chemistry.

EFB 326. Diversity of Plants (3)
Two hours of lecture and one three-hour laboratory. An evolutionary survey of plants from unicellular prokaryotes to multicellular eukaryotes. Coverage includes the algae, fungi, bryophytes, lower vascular plants, ferns, gymnosperms and angiosperms. Spring.
Prerequisites: EFB 226 or general biology.

EFB 335. Dendrology (2)
One hour of lecture and one three-hour laboratory/field trip. Field study, identification, and major characteristics of important forest trees of North America. Open only to students in the Forest Engineering curriculum. Fall.

EFB 336. Dendrology I (3)
Two hours of lecture and one three-hour laboratory/field trip. Field study, identification, natural history, and elementary silvics of important forest trees of North America. Fall.

EFB 340. Forest and Shade Tree Pathology (3)
Two hours of lecture and three hours of autotutorial laboratory. Major diseases of forest, shade, and ornamental trees and deterioration of forest products, with emphasis on disease identification, principles of disease development, effects of disease on the host, and practical control measures. Spring.

EFB 351. Principles of Forest Entomology (3)
Two hours of lecture, three hours of laboratory. Elements of insect classification, morphology and physiology; introduction to the role of insects in forested ecosystems; insect surveys, hazard rating, impact, control and other aspects of applied forest pest management. Designed for students in Resources Management. Spring.

EFB 352. Elements of Entomology (3)
Two hours of lecture, three hours of laboratory/field work. General classification of insects, morphology, physiology, ecology, behavior, and basic principles of population control. Emphasis through illustration is on the role of insects in the forest environment. Fall.

EFB 382. Wildlife Conservation (3)
Two hours of lecture, one hour of recitation. Introduction to the biological principles of conservation including the relationship of natural resources to modern society. The wildlife resource and its conservation will be emphasized. It is not designed for students concentrating in the area of Forest Wildlife Management. Fall.

EFB 385. Comparative Vertebrate Anatomy (4)
Three hours of lecture and three hours of laboratory per week. Analysis of vertebrate structure, with emphasis on comparative study of organ systems. Includes evolution of form and function, major adaptive patterns, and phylogenetic relationships in vertebrates. Spring.

EFB 386. Vertebrate Histology (3)
Two hours of lecture and three hours of laboratory. A study of tissues from protochordates, fishes, amphibians, reptiles, birds, and mammals, with emphasis on evolution, environment, and function, and with introduction to histopathologies. Spring.

EFB 387. Vertebrate Physiology (3)
Three hours of lecture. A study of functional responses of vertebrates to internal and external environmental conditions. Fall.

EFB 405. History of Natural Science (1)
One hour of lecture. A review of the history of western science from pre-Ionian times to Darwin, with evaluation of the impact of culture and religion on scientific progress. Spring.

EFB 407. Principles of Genetics (3)
Three hours of lecture and discussion. A general course covering concepts of genetics and evolution base to upper division biology and biochemistry courses. Includes the inheritance and analysis of Mendelian and quantitative traits, the chemical nature of the gene and its action, the genetic structure of populations and their evolution. Numerical methods for characterizing and analyzing genetic data are introduced. Spring.

EFB 408. Principles of Genetics Laboratory (1)
Three hours of autotutorial laboratory. Experiments with plants and animals and computer simulation exercises demonstrate the basic principles of inheritance of Mendelian and quantitative traits and changes in populations caused by major forces in evolution or by breeding procedures. Numerical methods for characterizing quantitative traits and for testing hypotheses are introduced. Spring.
Corequisite: EFB 407.

EFB 409. Introduction to Quantitative and Population Genetics (1)
Ten lecture-discussions and four autotutorial laboratories the second half of the semester (incl. Lecture-Lab Modules 5 and 6 of EFB 407 and 408). Basic genetic concepts of quantitative inheritance, the structure of populations and evolution. Laboratory experiments and computer simulations are used to demonstrate these concepts. Numerical methods for characterizing and analyzing genetic data are introduced. Spring.
Prerequisite: An introductory genetic lecture-laboratory course deficient in these areas of genetics and permission of the instructor.
Note: Not open to students taking EFB 407 and 408.

EFB 412. Introduction to Chemical Ecology (3)
Three hours of lecture with discussion. Centers on chemical signals among organisms from microbes to man as they affect ecology, physiology and behavior and as they can be utilized for agriculture, pest management, and animal husbandry.
Prerequisites: Biology (one year), organic chemistry (one year).
Note: Also listed as FCH 440.

EFB 415. Ecological Biogeochemistry (3)
Three hours of lecture and discussion. Investigation of the principles of biogeochemistry in ecosystems. The transformations and fluxes of elements in terrestrial and aquatic ecosystems including global cycles are emphasized. Fall.
Prerequisites: Courses in general ecology and introductory chemistry.

EFB 420. Field Experience—Internship (5)
Full-time for at least five weeks, or equivalent, of employment with an agency or professional involved in field activity. A resident faculty member is required to serve as course evaluator. Approval of curriculum director is necessary. See advisor for detailed procedural information. Summer.

EFB 421. Ecology of Freshwaters (2)
Half-time for four weeks. Cranberry Lake Biological Station. Experimental and observational studies of environmental and biotic interactions influencing productivity of freshwaters. Basic concepts at the organismic, population, and community level. Summer.

EFB 426. Plant Propagation (1)
One combined lecture-demonstration laboratory plus supervised greenhouse assignments. Instruction in principles and practices of plant propagation and in related greenhouse operations. Fall and Spring.
Prerequisite: Senior status in Environmental and Forest Biology curriculum.
Note: Cannot be used to satisfy the 6-hour biology curriculum requirement in the plant sciences.

EFB 435. Adirondack Flora (2.5)
Field study of summer flora of the Adirondacks including field identification and ecology of key species.

EFB 436. Dendrology II (1)
One three-hour field trip/laboratory. A continuation of Dendrology I emphasizing trees and shrubs ecologically important in the Central New York region and economically important in North America. Fall.

EFB 441. Field Plant Pathology (2.5)
Field study of plant diseases and decline with special emphasis on the field identification of different pathogens, including viruses, bacteria, fungi, insects, and pathogenic plants.

EFB 442. Field Mycology (2.5)
An introduction to the collection and identification of Adirondack fungi. Field techniques and laboratory identification of the major fungi found in selected ecosystems.

EFB 443. Plant Virology (3)
Two hours of lecture and three hours of laboratory. History of plant virology, identification and characterization of plant viruses, including transmission mechanisms, vector relationships, purification, and serology. Laboratory will present techniques for the identification and characterization of plant viruses. Spring (even years).
Prerequisite: EFB 303, equivalent, or consent of the instructor.

EFB 445. Plant Ecology (3)
Two hours of lecture and discussion and one laboratory session. A first course in plant community ecology dealing with the dynamics of community development and change and the process of community analysis and description. Spring.
Prerequisite: EFB 320.

EFB 448. Physiological Ecology of Plants (3)
Three hours of lecture. Examination of the interactions between plants and their environment. Emphasis will be given to the physiology of plants as it is modified by fluctuating external conditions and the mechanisms of plant adaptation. Students completing EFB 448 should not enroll in EFB 330. Fall.
Prerequisites: An introductory course in physics, EFB 320 and EFB 326.

EFB 451. Pest Management—Theory and Practice (2)
Two hours of lecture for nine weeks; then one lecture hour and one three-hour laboratory for four weeks. A review of history and governmental policy for four weeks. A review of history and governmental policy of pest management, as well as basic instruction in theory and practicum. Fall.
Prerequisite: EFB 352 or equivalent.

EFB 452. Principles of Chemical Control (3)
Two hours of lecture; one three-hour laboratory. A study of the chemistry, toxicology, handling and application of chemicals used to manage pest populations. A primer for the State Pesticide Application examinations. Spring.
Prerequisite: EFB 451.

EFB 453. Forest and Aquatic Insects (2)
The forest and aquatic insects of Cranberry Lake Region and their role in these environments and habitats. Insect collection required. Summer.

EFB 454. Wood Deterioration by Insects (3)
Three hours of lecture, discussion, and demonstration. Biology, identification, ecology of insect and wood interrelations; prevention of injury and control of insects injurious to forest products and wood in use. Spring.
Prerequisite: EFB 352 or equivalent.

EFB 476. Vertebrate Ecology (2.5)
Utilization of unique Adirondack forms and communities to study population dynamics, behavior, systematics, and the ecological role of vertebrates; standard field and laboratory techniques.

EFB 478. Microcommunity Ecology (2.5)
Field study of terrestrial invertebrate microcommunities; descriptive and comparative assay of microhabitats incorporating experimental and field techniques. Summer.

EFB 479. Field Ornithology (2.5)
Field study of the ecology, distribution, and behavior of birds in the Adirondack region. Techniques used in conducting field studies in avian biology will be emphasized (including mist netting, banding, field identification, and avian censusing).

EFB 480. Principles of Animal Behavior (4)
Three hours of lecture, one hour of recitation per week. A study of the basic principles of animal behavior, stressing exogenous and endogenous mechanisms of control, with emphasis on the evolution of behavior. Spring.

EFB 481. Behavioral Ecology (2.5)
Study of the behavioral adaptations of animals to their environment. Emphasis will be placed on field observation and experimentation. Habitat selection, foraging, mating, and social behavior will be considered.
Prerequisite: EFB 480 Principles of Animal Behavior or equivalent behavior course.

EFB 482. Invertebrate Zoology (4)
Three hours of lecture, three hours of laboratory. Structure, function, classification, and evolution of invertebrates. Emphasis on ecological role of invertebrates in specific habitats. Fall.

EFB 483. Biology of Birds and Mammals (4)
A course surveying the taxonomy, anatomical-behavioral-physiological adaptations and natural history of birds and mammals. Techniques for the field study of a vertebrate species will be discussed. Fall.

EFB 485. Herpetology (3)
Two hours of lecture and three hours of laboratory. An introduction to the structure, function, ecology, behavior, development, and distribution of amphibians and reptiles as they relate to the systematics of the various groups. Spring.

EFB 486. Ichthyology (3)
Two hours of lecture, three hours of laboratory. An introduction to the anatomy, physiology, ecology, behavior, and taxonomy of fishes. Spring.

EFB 487. Fishery Biology (4)
Three hours of lecture and three hours of laboratory. Introduction to models of growth, mortality, production, and exploitation; aspects of fish ecology and behavior related to the dynamics and management of fish populations. Fall.
Prerequisite: EFB 486 or equivalent.

EFB 488. Ecology of Adirondack Fishes (2.5)
Study of the ecology of fishes, with detailed individual investigation of the ecology of Adirondack fishes.

EFB 490. Wildlife Ecology and Management (3)
Three hours of lecture. A study of the ecological principles governing wild animal populations and their habitats and the relationship of these principles to management programs and decisions. Spring.
Prerequisites: EFB 320 or equivalent.

EFB 491. Wildlife Ecology and Management Practicum (2)
One hour discussion, three hours laboratory. Practical contact and experience with wildlife management techniques and programs; relates practices to principles of management. Designed for biology students wishing to pursue careers as wildlife biologists. Spring.
Corequisite: EFB 490; *Pre- or corequisite:* LIB 300.

EFB 492. Seminar in Ecology (1)
One hour of presentations and discussion. A topic in ecology will be emphasized and its importance to contemporary environmental issues will be addressed. Spring.
Prerequisite: 90 credit hours; Introductory course in ecology.

EFB 496. Topics in Environmental and Forest Biology (1-3)
Experimental, interdisciplinary, or special coursework in biology for undergraduate students. Subject matter and method of presentation varies from semester to semester. May be repeated for additional credit. Fall or Spring.

EFB 497. Seminar (1)
One hour of presentations and discussion. A topic in Environmental and Forest Biology will be emphasized and its importance to contemporary issues will be addressed. Fall or Spring.
Prerequisite: 90 credit hours.

EFB 498. Research Problems in Environmental and Forest Biology (1-3)
Independent research in topics in Forest Biology for the superior undergraduate student. Selection of subject area determined by the student in conference with appropriate faculty member. Tutorial conferences, discussions and critiques scheduled as necessary. Final written report required for departmental record. Fall, Spring, and/or Summer.

EFB 500. Forest Biology Field Trip (1-3)
A five- to ten-day trip to (1) agencies engaged in biological research, management, and administration, or (2) regions or areas of unusual biological interest. A final report is required. Estimated student expense, $75. Fall or Spring.

EFB 501. Introduction to Genetic Engineering (3)
Three hours of lectures. The concepts and processes of recombinant DNA technology for the manipulation of genomes of plants, animals, fungi, and bacteria to produce new organisms of practical value. Spring.

EFB 505. Microbial Ecology (3)
Two hours of lecture and three hours of laboratory. Applied and environmental aspects of microbiology with emphasis on biochemical interactions. Examining microbial processes and interrelationships in aquatic and terrestrial ecosystems. Spring.

EFB 510. Health and Our Chemical Environment (3)
Three hours of lecture and discussion. Analysis of our chemical environment and discussion of health hazards of anthropogenic and natural chemicals in environment associated with typical life styles of our society. Emphasis is on basic toxicological principles, scientific basis of regulations and risk assessment for balanced judgment of issues on health hazards of environmental chemicals.

EFB 515. Population Ecology (3)
Two hours of lecture and three hours of laboratory. Description, analysis, evolution, interactions and stability of natural and experimental populations. Spring.
Prerequisite: EFB 320 or equivalent.

EFB 518. Systems Ecology (4)
Three hours of lecture and three hours of laboratory/field experience. Survey of history, literature, and techniques of systems ecology, including, especially, the teaching of intellectual, basic mathematical, and computer skills that allow the student to take an environmental problem of his or her choosing and simulate it on a computer. Fall.
Prerequisites: One course in ecology. It is also recommended that the student have at least some previous or concurrent experience with computers. Weekend field trip required.

EFB 520. Pest Management Systems in Forestry (3)
An in-depth analysis of management systems developed for forest pest problems. This course examines the concepts and processes of integrated pest management systems in forestry. It analyzes the major forest insect and disease systems developed in recent years. Vegetation management and pesticide use in forestry are also covered. A forest management plan is prepared and defended according to preestablished guidelines. The course is required for the Master of Forestry degree and is part of a sequence of Forest Entomology, Pest Management, and Forest Pathology courses offered. Spring.
Prerequisites: EFB 351/352 or basic entomology; *or* forest pathology.

EFB 524. Limnology (3)
Three hours of lecture. An introduction to the physics, chemistry, and biology of inland waters, with particular emphasis on lakes. The course focuses on lakes as integrated ecosystems, and analyzes perturbations in this environment on the structure and function of the biological communities contained therein. Fall.
Prerequisites: Introductory courses in physics and chemistry, and EFB 320.

EFB 525. Limnology Laboratory (1)
One laboratory or field trip. An introduction to limnological techniques and the procedures for empirically analyzing ecological relations in aquatic ecosystems. Field trips to local aquatic habitats. Fall.
Co- or Prerequisite: EFB 524.

EFB 526. Introduction to Plant Tissue Culture (3)
One hour of lecture and six hours of laboratory designed to introduce students to the scientific and commercial uses of plant tissue culture.
Prerequisite: A semester of General Botany or equivalent.

EFB 529. Ecology of the Soil-Plant System (3)
Three hours of lecture and discussion. The course develops the foundations of and understanding in soil-plant relationships with emphasis on soil nutrients and trace elements. Role of the nutritional factor in population abundance and distribution, competition, allelopathy, species endemism, community development (succession), and anthropogenic factors are covered.
Prerequisites: EFB 320, or EFB 445, or equivalent.

EFB 530. Plant Physiology (3)
Three hours of lecture. Internal processes and conditions in higher plants with emphasis on physiological and biochemical concepts. For students majoring in the biological sciences. Spring.
Prerequisites: EFB 325, EFB 326.
Note: EFB 531 also required for Plant Sciences Concentration students.

EFB 531. Plant Physiology Laboratory (2)
Two laboratory sessions. Introduction to methods and procedures of physiological research. Spring.
Prerequisites: Co-requisite EFB 530, or permission of the instructor.

EFB 532. Plant Anatomy (3)
Two hours of lecture and three hours of laboratory. An introductory course in plant anatomy designed to familiarize the student with the organization and development of the primary and secondary plant body of higher plants. Spring.
Prerequisite: EFB 326.

EFB 533. Chemical Defenses of Plants (3)
Three hours of lecture/discussion about the ways in which plants defend themselves chemically against microorganisms, insects, herbivores, and other plants. Fall.
Prerequisite: A course in physiology or biochemistry.

EFB 535. Systematic Botany (3)
Two hours of lecture and three hours of laboratory. Identification, nomenclature, and classification of flowering plants with special emphasis

on local flora and on developing the ability to classify the plants of any region. Fall.
Prerequisites: EFB 326, EFB 327.

EFB 540. Mycology (3)
Two hours of lecture and three hours of laboratory. Fundamentals of the morphology, taxonomy, cytology, life histories, and ecology of fungi. Fall.

EFB 541. Wood Microbiology (3)
Two hours of lecture and three hours of laboratory/field trip. Survey of lignicolous microorganisms, their roles in the degradation of wood, and principles of their control. Detailed consideration of all types of decay of wood and its products from chemical, ultrastructural, biotechnological and ecological perspectives. Fall.

EFB 542. Freshwater Wetland Ecosystems (3)
Three hours of lecture. An examination of the structure and function of various freshwater wetlands. Ecologic principles that broadly apply to all wetland ecosystems are examined and contrasted with terrestrial systems. The effect of management activities on, and the management potential of, wetlands are also examined.
Prerequisite: EFB 320 or equivalent.

EFB 545. Forest Decline Concepts (3)
Three hours of lecture/discussion per week. Environmental stress factors will be integrated into forest decline concept models using specific examples from forest pathology, forest entomology, ecology, resource management and current environmental topics. Fall.

EFB 551. Forest and Shade Tree Entomology (2)
Two hours of lecture. Important forest and shade tree insects, detection, evaluation, prevention, and control of their damage; their relation to silviculture and management of forests and shade trees. Spring.
Prerequisite: EFB 352 or equivalent.

EFB 552. Forest and Shade Tree Entomology Laboratory (1)
Three hours of laboratory/field trip. Identification of important forest and shade tree insects and their damage. Spring.
Pre- or Corequisite: EFB 551.

EFB 553. Biological Control (2)
Two hours of lecture. Theory and practice of biological control ofsect pests and weeds. Emphasis on the ecology and utilization of major groups of predators, parasitoids, and pathogens used in pest management and interpretation of mortality. Fall (odd years).
Prerequisite: EFB 352 or equivalent.

EFB 554. Aquatic Entomology (3)
An introduction to the identification, life histories, and ecology of aquatic insects, with emphasis on genera found in the northeastern U.S. Includes a consideration of the functional role of insects in aquatic systems, and current avenues of research. Intended for seniors and graduate students pursuing interests in entomology, fisheries and wildlife, forestry, limnology and general ecology. Fall.
Prerequisite: One course in entomology or permission of the instructor.

EFB 560. Environmental Toxicology of Insecticides (3)
Two hours of lecture. Basis of action of insecticides in living systems, behavior of insecticides and microtoxicants in environment, interaction of insecticides and biological systems. Fall.
Prerequisite: EFB 325 or equivalent course in physiology or biochemistry.

EFB 561. Medical Entomology (3)
Three hours of lecture and recitation. Study of arthropods affecting man, domestic animals, and wildlife with emphasis on their biology, control, and relationships to vertebrate disease. Spring (even years).
Prerequisite: EFB 352 or equivalent.

EFB 565. Insect Morphology (3)
Two hours of lecture and three hours of laboratory. A comparative study of the external morphology of insects emphasizing evolutionary trends, especially modifications of homologous structures. Topics of special importance include intersegmental relationships, feeding, sensory mechanisms, locomotion, and reproduction. Spring.
Prerequisite: EFB 352.

EFB 570. Insect Physiology (3)
Two hours of lecture and three hours of laboratory. Study of the life processes in insects; introduction to modern physiological instrumentation and laboratory methods. Spring.
Prerequisite: EFB 325.

EFB 578. Terrestrial Community Ecology (3)
Three hours of lecture. Relation of terrestrial vertebrates and invertebrates to their physical, chemical, and biological environment. Emphasis on community principles, structural quantification, and evolutionary processes of terrestrial animals. Fall.
Prerequisite: EFB 320 or equivalent.

EFB 580. Wetland Wildlife Ecology and Management (3)
An assessment of important wildlife resources associated management within coastal and freshwater wetlands in North America. The course also covers state and federal wetland classification schemes, regulations, policy, and specific topics in wetland wildlife management.

EFB 590. Wilderness Wildlife Management (2.5)
The ecology, philosophy, and politics of wilderness wildlife management, including wilderness ecosystems, some field characteristics of Adirondack wilderness, and management of selected wilderness species.
Prerequisite: EFB 490, or equivalent introductory course in wildlife management.

EFB 601. Molecular Biology Techniques (3)
One hour of lecture and six hours of laboratory. Techniques used in molecular biology research are presented, including the extraction, measurement, analysis, and manipulation of nuclear and organellar DNAs of plants and fungi. Some methods on RNA and proteins will be covered. Fall.
Prerequisites: FCH 530, 531, and 532.

EFB 602. Genetic Engineering of Eucaryotes (3)
Three hours of lecture. Genetic engineering of eucaryotic organisms with emphasis on plant and fungal systems. Principles and current research will be covered.
Prerequisites: EFB 407, FCH 530, and 532, or equivalent.

EFB 607. Breeding Plants for Resistance to Disease and Pests (2)
Two hours of lecture and discussion. Principles, methods, and strategies in breeding for resistance to diseases and pests. The effectiveness, durability, and limitations of resistance breeding in pest management and control are considered.
Prerequisites: Introductory courses in genetics or forest tree improvement and in forest pathology or entomology, or permission of the instructor.

EFB 610. Ecological Biogeochemistry (3)
Three hours of lecture and discussion. Investigation of the principles of biogeochemistry in ecosystems. The transformations and fluxes of elements in terrestrial and aquatic ecosystems including global cycles are emphasized. Fall.
Prerequisites: Courses in general ecology and introductory chemistry.

EFB 612. Introduction to Chemical Ecology (3)
Three hours of lecture with discussion. Centers on chemical signals among organisms from microbes to man as they affect ecology, physiology, and behavior and as they can be utilized for agriculture, pest management, and animal husbandry. This course is a companion to EFB 412/FCH 440.

EFB 625. Membranes and Biological Transport (3)
Two hours of lecture and one hour of discussion. Composition, structure, and physical properties of membranes. Membrane functions including

transport, bioelectricity, and cell compartmentalization. Specific transport processes in biological systems. Fall (even years).

Prerequisites: One semester of biochemistry and an advanced physiology course.

EFB 630. Fungus Physiology (3)
Two hours of lecture and one hour of discussion. Principles of growth, reproduction, and differentiation of the fungi emphasizing the role of the environment in controlling fungal processes. Spring (even years).

Prerequisite: Two semesters of physiology or biochemistry.

EFB 632. Plant Growth Regulation (3)
Three hours of lecture/discussion on topics concerned with the biochemistry and physiology of plant hormones and synthetic growth regulators. Fall.

Prerequisite: A course in plant physiology or biochemistry.

EFB 635. Topics in Plant Nutrition (2)
Two hours of lecture, discussion, and seminars. Advanced course dealing with selected topics of mineral and organic nutrition of plants. Fall (odd years).

Prerequisites: Completion of one or more physiologically-oriented plant science courses.

EFB 641. Phytopathology (3)
Two hours of lecture and discussion and three hours of autotutorial laboratory. Principles and concepts of plant pathology. Major diseases of ornamental plants, vegetable crops, fruit crops, field crops, and trees. This is an introductory plant pathology course for graduate students in all departments. Spring.

EFB 642. Epidemiology and Management of Tree Disease (3)
Three hours of lecture and discussion, with occasional laboratory or field trip. Brief history of phytopathology, study of epidemiological principles and their application in tree disease management. Survey of disease management strategies in various regions of the U.S. Spring (odd years).

Prerequisite: EFB 340.

EFB 643. Plant Virology (3)
Two hours of lecture and three hours of laboratory. History of plant virology, identification, and characterization of plant viruses, including transmission mechanisms, vector relationships, purification, and serology. Laboratory will present techniques for the identification and characterization of plant viruses. Spring (even years).

Prerequisite: EFB 303, equivalent, or consent of the instructor.

EFB 645. Plant Ecology (3)
Two hours of lecture and discussion and one laboratory/discussion. A first course in plant community ecology for beginning graduate students focusing on dynamics of community development and change and the processes of community analysis and description. Spring.

Prerequisite: EFB 320 or equivalent.

EFB 651. General Insect Taxonomy (3)
Two hours of lecture and three hours of laboratory. Identification and classification of the important orders and families of insects; acquaintance with pertinent taxonomic literature and use of keys; and understanding of evolutionary principles and concepts and a knowledge of systematic theory and practice. Insect collection required. (Alternative odd years.)

Prerequisite: EFB 565.

EFB 660. Insecticide Toxicology Laboratory (2)
One hour of discussion and three hours of laboratory. Laboratory experiments in mode of action and behavior of insecticides, biological and instrumental analysis of insecticides including tracer analyses. Spring (odd years).

Prerequisites: EFB 560 or equivalent and permission of the instructor.

EFB 678. Practicum in Terrestrial Community Ecology (3)
One hour of lecture, one hour TBS, and three hours of laboratory. Intensive practical application of ecological principles to the study of terrestrial animal communities. Includes experimental and field collection of data, quantifications, synthesis, and final reporting. Fall.

Pre- or Corequisite: EFB 578 or equivalent.

EFB 680. Behavioral and Physiological Ecology (3)
Two hours of lecture and one hour of discussion. An examination of the concepts of animal adaptations to ecological change from a behavioral point of view. Particular emphasis will be placed on the role the environment plays in shaping the behavior of a given species. Behavioral and physiological responses to environmental conditions will be treated as a continuum. Spring (odd years).

Prerequisites: One course in ecology, behavior, and physiology.

EFB 682. Invertebrate Symbiosis (3)
Two hours of lecture and one three-hour laboratory. An introduction to the ecology and evolution of interspecific relationships of invertebrates. Spring (even years).

Prerequisites: EFB 320, EFB 482.

EFB 690. Management of Wildlife Habitats and Populations (4)
Three hours of lecture and three hours of laboratory; some weekend field trips. For graduate students intending to enter professions in natural resource management, especially fish and wildlife and forestry. Focus is on the application of ecological principles and management techniques in the planning of habitat and harvest management programs for wildlife. Extensive independent work required. Fall.

Prerequisite: EFB 491.

EFB 691. Habitat Inventory and Evaluation (3)
Four hours of lecture and discussion. For students intent on careers in natural resource management, environmental planning or environmental impact analysis. Focus is on methods for investigation of species-habitat relationships, and construction of models for the inventory and evaluation of habitat. State-of-the-art habitat evaluation procedures are explored. Spring.

Pre- or Corequisite: Multivariate Statistics.

EFB 692. Ecology and Management of Waterfowl (3)
A detailed examination of waterfowl ecology and management. The course is structured around the annual cycle, focusing on strategies of survival and reproduction; management aspects are treated throughout the course. Fall.

EFB 695. Urban Wildlife (2)
Three hours of lecture and discussion with field trips. A study of the occurrence, adaptations, and values of wildlife in urbanized areas, with emphasis on current research and agency programs. Spring (even years).

EFB 720. Topics in Soil Invertebrate Ecology (3)
Two one-hour lecture and discussion periods and a three-hour laboratory. Study of literature relating to soil invertebrate microcommunities; taxonomy, culturing, and collection methods of soil fauna; student will conduct an individual research problem. Spring (odd years).

EFB 724. Seminar in Aquatic Ecology (1)
Two hours of lecture and discussion. A seminar to explore in some depth areas of current research in aquatic ecology. Fall (even years).

Prerequisite: Six credits in aquatic ecology.

EFB 733. Techniques in Plant Physiology (2-4)
Comprehensive study of techniques essential for research in plant physiology. Students may choose the instructors they wish to work with, and should consult the instructors for further details. May be repeated for credit in different specialties. Fall and Spring.

Prerequisites: EFB 531 or equivalent, biochemistry with laboratory.

EFB 740. Mycorrhizae (3)
Two hours of lecture and three hours of laboratory/discussion. A basic background course covering structural, functional, and ecological aspects of mycorrhizae; their methods of field and laboratory study; and applications in forestry practice. Fall (odd years).

EFB 741. Topics in Phytopathology (3)
Two two-hour lectures and discussions. Discussions of specific subject

in phytopathology and wood microbiology. Topic selection is based on availability of expertise and will be announced in advance. This course may be repeated for credit in different specialties. Fall or Spring.

EFB 745. Topics in Plant Ecology (2)
Two hours of seminar and discussion. An advanced course dealing with current research in plant community dynamics. May be repeated for additional credit. Fall.
Prerequisite: EFB 445 or EFB 645.

EFB 790. Topics in Wildlife Biology (1-3)
Hours to be arranged. Group study of a wildlife management topic. Fall or Spring.
Prerequisite: Six credits of wildlife management courses.

EFB 796. Topics in Environmental and Forest Biology (1-3)
Special instruction, conference, advanced study, and research in selected subject areas. Typewritten report required. Check *Schedule of Courses* for details. Fall and Spring.

EFB 797. Seminar in Environmental and Forest Biology (1)
Seminar discussions of subjects of interest and importance in environmental and forest biology. Seminar offerings are available in most subdisciplinary areas. Check *Schedule of Courses* for details. Fall and Spring.

EFB 798. Research Problems in Environmental and Forest Biology (Credit hours to be arranged)
Individual advanced study of selected special problems in environmental and forest biology. Offered by arrangement with individual faculty. Typewritten report required. Fall and Spring.

EFB 830. Physiology of Growth and Development (2)
Lecture. A study of the growth and development of plants and the physiological and biochemical processes that influence the development of form and structure in higher plants. Fall (even years).
Prerequisites: EFB 530, EFB 532, and organic chemistry.

EFB 840. Advanced Mycology, Homobasidiomycetes (3)
Review of selected literature as well as laboratory training in identification and research techniques. Fall.
Prerequisite: EFB 540.

EFB 841. Advanced Mycology, Heterobasidiomycetes (3)
Review of selected literature as well as laboratory training in identification and research techniques. Spring (even years).
Prerequisite: EFB 540.

EFB 842. Advanced Mycology, Ascomycetes (3)
Review of selected literature as well as laboratory training in identification and research techniques. Spring (odd years).
Prerequisite: EFB 540.

EFB 843. Advanced Mycology, Deuteromycetes (3)
Review of selected literature as well as laboratory training in identification and research techniques. Fall (even years).
Prerequisite: EFB 540.

EFB 851. Advanced Insect Taxonomy (3)
Two hours of lecture and three hours of laboratory. Methods, procedures, and concepts of systematics. Examples and material will be drawn from among important groups of forest insects. Fall.
Prerequisite: EFB 651.

EFB 898. Professional Experience (1-12)
Professional experience which applies, enriches, and/or complements formal coursework. Graded on an "S/U" basis. Fall, Spring, and Summer.

EFB 899. Master's Thesis or Project Research (1-12)
Investigation leading to the completion of a research-oriented thesis or to an application-oriented project. Graded on an "S/U" basis. Fall, Spring, and Summer.

EFB 980. Topics in Animal Behavior (2)
Two hours of lecture and discussion. A seminar-type course designed to explore in depth selected and controversial subject areas in animal behavior. Fall or Spring.

EFB 999. Doctoral Thesis Research (1-12)
Investigation leading to the completion of the doctoral thesis. Graded on an "S/U" basis. Fall, Spring, and Summer.

EIN—ENVIRONMENTAL INFLUENCES (LANDSCAPE ARCHITECTURE)

(See also courses listed under CMN and LSA.)

EIN 371. American Landscape History (3)
Three hours of lecture and discussion per week. The history of human-environmental interaction in America since colonial times. Reviews the prevalent ideas and attitudes during various periods, and the development of the environmental professions. Uses a humanistic and ecological approach to understand the landscape in relation to changes in population, technology, economics, social organizations, and attitudes. Fall or Spring.
Prerequisite: Landscape Architecture major or permission of the instructor. A student may not receive credit for both EIN 371 and EST 371.

EIN 390. Social/Cultural Influences and Environmental Form (3)
Three hours of lecture. This course provides an introduction to an interdisciplinary social science analysis of human settlements. The course introduces the basic concepts, vocabulary, theories, and units of analysis for an interdisciplinary social perspective of the environmental form of human settlements. As such, it focuses upon developing an understanding of the context for the planning and design of human settlements. Course requirements include readings, examinations, and reports. Field trips may be scheduled. Spring.

EIN 451. Fundamentals of City and Regional Planning (3)
Three hours of lecture per week. Lectures, assigned readings, written reports. Discussion of the meaning and purposes of city and regional planning. Examination of the historical development of urban places. Explanation of the principal elements of the comprehensive planning process, including goal formulation and decisionmaking, social and advocacy planning, planning for community facilities, and planning administration. Discussion of the methods and objectives of city and regional planning. Spring.
Prerequisite: Permission of the instructor.

EIN 471. History of Landscape Architecture (3)
Three hours of lecture. Informal lectures and class participation, reports, assigned text and assigned reserve shelf reading, optional text and handout notes, quizzes and exams. Slides. Historical study and style analysis of Western man's efforts to design his environment and his changing attitudes and relationships to environment. Also, non-Western coverage where significant or influential on Western Man. Study of historical personalities as well as periods that are of environmental concern up into the modern period. Fall.
Prerequisite: Permission of the instructor.

EIN 496. Special Topics in Environmental Studies (1-3)
Special topics of current interest to undergraduate students in Environmental Studies and related fields. A detailed course subject description will be presented as the topic area is identified and developed. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor.

EIN 510. Creative Problem Solving Seminar (3)
Three hours of lecture and discussion. A course designed to extend the student's understanding and application of creative problem solving processes. One requirement will be to select and carry out an application of the techniques to a particular problem, with consultation and guidance from the instructor. Critique and survey of the literature on creativity, in-depth analysis of the synectics process, and various procedures which have been developed for nurturing creative behavior comprise the essence of the program. Spring.

EIN 560. Negotiating Environmental Disputes (3)
Two hours of lecture and two hours of recitation/workshop per week. An introductory course to help students acquire and refine skills in listening, problem solving, assertion, and conflict management. These interpersonal skills are useful in many situations; however, the emphasis will be upon using them to resolve environmental conflicts. Approaches to learning will include theory presentation, skill demonstration, skill practice and critique. Fall or Spring.

ENS—ENVIRONMENTAL SCIENCE

ENS 505. Waste Management (3)
A multidisciplinary course. Course begins with foundation materials and progresses through a series of field trips and guest lectures aimed at preparing students to develop and communicate details of feasible alternative designs for waste management facilities/programs for specific case studies. Enrollment limited. Fall.
Prerequisite: Permission of the instructor.

ENS 601. Water Resources Management (3)
Three hours of lecture and discussion. This course provides an introduction to interdisciplinary water management. It draws upon subject matters from many areas, including water policy, planning, economics, hydrology, law, engineering, and water quality. Fall.

ENS 611. Environmental Institutions (3)
Three hours of lecture and discussion per week. Examination of the interrelationships of policymaking and environmental program implementation in government, the role of the legal process in environmental management, and techniques for program evaluation. Fall.

ENS 612. Environmental Information Systems (3)
Two credit hours of lecture/discussion and three credit hours of laboratory per week. Description and quantification of land resources and human activities as a basis for subsequent environmental modeling and policy analysis. Fall.
Prerequisite: Statistics is pre- or co-requisite.

ENS 621. Environmental Policy Analysis (3)
Three hours of lecture and discussion per week. Theoretical approaches to environmental policy studies and applied economic, political science and legal approaches to policy analysis, quantitative assessment, modeling, benefit/cost analysis, risk assessment, and decision analysis.
Pre- or co-requisite: Economics and statistics. Spring.

ENS 622. Environmental Systems (3)
Two hours of lecture and discussion per week and three hours of computer lab per week. Introduction to systems theory and development of modeling concepts; modeling and computer simulation of complex social and physical systems in applied environmental contexts. Spring.
Pre- or co-requisite: Statistics and ecology.

ENS 696. Special Topics in Environmental Science and Policy (1-3)
Experimental and developmental courses in new areas of interest to environmental studies faculty and graduate students not covered in regularly scheduled courses.

ENS 796. Advanced Topics in Environmental Science and Policy (1-3)
Lectures and discussions, seminars, conferences, and group research on advanced topics of special or current interest, in fields of interest to environmental studies faculty and graduate students. Fall and Spring.

ENS 797. Environmental Science Seminar (1-3)
Discussion of current topics and research related to environmental science. Fall and Spring. Staff.

ENS 798. Problems in Environmental Science and Policy (Credit hours to be arranged)
Individualized, special study of environmental science and policy subjects and issues. Comprehensive oral or written report required for some problems. Fall, Spring, and Summer.

ENS 898. Professional Experience (1-12)
Professional experience which applies, enriches, and/or complements formal coursework. Graded on an "S/U" basis. Fall, Spring, and Summer.

ENS 899. Master's Thesis Research (Credit hours to be arranged)
Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

ENS 999. Doctoral Thesis Research (Credit hours to be arranged)
Research and independent study for the doctoral degree and dissertation. Fall, Spring, and Summer.

When choosing courses, students must consult their advisors/major professors.

ERE—ENGINEERING (ENVIRONMENTAL AND RESOURCE ENGINEERING)

ERE 306. Elements of Map and Air Photo Interpretation (1)
Two hours of lecture and three hours of laboratory per week for five weeks of a semester. Introduction to map and photograph interpretation to extract information useful to site and resource inventory, analysis, planning, and design activities. The basic physical and geometric properties of maps and photographs, the characteristics of information contained in them, and elementary principles and procedures of interpretation are discussed. Spring.
Prerequisite: College level algebra and plane trigonometry.

ERE 308. Elements of Plane Surveying (1)
Two hours of lecture and three hours of laboratory per week for the last five weeks of the semester. Introduction to the principles and procedures of plane surveying for mapping and construction layout purposes. Topics briefly discussed include the basic mathematical principles of surveying, the types and uses of surveying, horizontal and vertical distance measurement, angle measurement, traversing and computations, construction layout, tacheometry, and surveying errors (and their treatment). Spring.
Prerequisite: College level algebra and plane trigonometry.

ERE 320. APL for Engineers and Scientists (2 or 3)
Programming and operation of time-sharing digital computer systems via the APL language. Analysis, modeling, and solution of basic problems in environmental science and engineering. Students desiring three credits will complete an original, substantial term project. Spring.
Prerequisites: Calculus and physics or permission of the instructor.

ERE 350. Wood Preservation (2)
Two hours of lecture with some demonstrations. A survey of basic wood-water relationships, shrinking and swelling, elementary wood structure, wood seasoning and drying, wood permeability, capillary forces, heat transmission, agencies of wood deterioration, wood preservation processes, wood fire performance, fire tests, and fire retardant treatments. Not open to WPE students. Fall.

ERE 351. Basic Engineering Thermodynamics (2)
Principles of energy conservation and conversion: first and second laws. Relation to PVT behavior, property functions, equilibria, and heat and mass transfer. Introduction to engineering problem analysis and computer methods. Spring.
Prerequisites: Physics, general chemistry, and calculus. Not open for credit to students who have completed successfully FCH 360 or equivalent.

ERE 352. Applied Engineering Thermodynamics (2)
Classical principles applied to devices and systems. Emphasis on efficient design of manufacturing equipment and processes. Power and refrigeration cycles; energy conservation; materials recovery. Environmental case studies and design project. Computer-aided data correlation and system simulation. Spring.
Prerequisites: ERE 351, FCH 360, or equivalent.

ERE 362. Mechanics of Materials (3)
Three hours of lecture. Theories of stress, deformation, and stability of common structural materials subjected to various force systems. Fall.
Prerequisites: Integral calculus and statics.

ERE 364. Engineering Materials (3)
Two hours of lecture and one three-hour laboratory per week. An introduction to the scientific study of materials used in industry. Metals, ceramics, and polymers are covered. Lab work includes fabrication, testing, and evaluation of actual systems. Spring.
Prerequisites: Junior standing, physics, chemistry, and engineering mechanics.

ERE 371. Surveying for Engineers (3)
Two hours of lecture and recitation and three hours of laboratory. The principles of plane surveying for engineers. Subject matter areas include introduction to the theory of measurement and errors, reference surfaces, linear and angular measurements in both the horizontal and vertical planes, traversing and computations, horizontal and vertical control and associated computations, areal and volumetric computation, construction surveying including circular and parabolic curves, coordinate systems, property and public land surveys, the analysis and treatment of systematic and random errors. Laboratory field work and computations culminate in a topographic map. Elementary computer processing is introduced. Fall.
Prerequisites: Calculus.

ERE 375. Elementary Corrosion (1)
One hour of lecture. Basic electro-chemistry, film formation and passivation, galvanic corrosion and pitting, cathodic and anodic protection, protective coatings and inhibitors. Application of the above in the home, car, field, at sea, and in industrial plants. Spring.

ERE 420. Computer Applications in Science and Engineering (3)
Principles and methods of mathematical modeling for analog and digital computer solution. Applications to data reduction and correlation, statistical analysis, process and equipment simulation, optimization and control, and computer-assisted instruction. Typical examples, class problems and student projects. Current status and future projection of computational equipment, software and operating techniques. Fall.
Prerequisites: Calculus and computer programming, or permission of the instructor.

ERE 422. Process Design and Simulation (3)
Two hours of lecture/discussion and three hours of design laboratory per week. Mathematical modeling of process units and systems. Consideration of energy requirements, operating costs, and optimization techniques. Steady-state and dynamic simulation via computer programs. Use of data sources and software, applied to design exercises and case studies. Spring.
Prerequisites: Unit operations and computer programming, or permission of the instructor.

ERE 440. Water Pollution Engineering (3)
Two hours of lecture and three hours of laboratory. Introduction to the physical, chemical, and biological parameters of waste water treatment processes and to the principles of the unit operations involved. Study of the design parameters and design procedures of waste water treatment systems. Spring.
Prerequisites: Physics and CHE 356 or equivalent.

ERE 441. Air Pollution Engineering (3)
Three hours of lecture and discussions. Study of the chemical, physical and meteorological principles of air pollution and its control. Local and global effects of air pollution. The atmospheric survey. Examination of the operating principles and design parameters of the various air pollution control systems. Air quality and emission standards. Fall.
Prerequisites: Physics and CHE 356 or equivalent.

ERE 496. Special Topics (1-3)
Lectures, readings, problems, and discussions. Topics as announced in the areas of environmental or resource engineering. Fall and/or Spring.

ERE 500. Engineering Fundamentals (3)
This course provides a foundation and frame-of-reference for non-engineers entering graduate study. Completion enables nonengineering students to solve simple, applied problems in engineering science fundamentals. The course also helps the student recognize good and poor approaches to problem formulation and analysis, and to be better prepared to deal with technical, social, and economic constraints on environmental problem solving. Enrollment limited. Fall.
Prerequisite: Permission of the instructor.

ERE 505. Waste Management (3)
A multidisciplinary course. Course begins with foundation materials and progresses through a series of field trips and guest lectures aimed at preparing students to develop and communicate details of feasible alternative designs for waste management facilities/programs for specific case studies. Enrollment limited. Fall.
Prerequisite: Permission of the instructor.

ERE 510. Energy: Alternate Systems (3)
Three hours of lecture. An introduction to alternate energy resources and conversion processes. Focus is on relatively small-capacity, decentralized systems and means for judging appropriateness, costs, and impacts of application under varying conditions and needs. Instruction modules on passive and active solar heating, wind energy system, biomass resources and conversion, including ethanol production, methane recovery and wood gasification, and internal combustion cogeneration.

ERE 552. Fundamentals of Remote Sensing (3)
Two hours of lecture and three hours of laboratory per week. Principles and techniques of environmental remote sensing including potentials, limitations, instrumentation, and unique requirements. Procedures and principles of acquiring, analyzing, and using a wide range of imagery types for environmental applications and design. Both qualitative and quantitative interpretation procedures are presented. Oriented for multidisciplinary participation. Fall or Spring.
Prerequisite: College physics and calculus or consent of the instructor.

ERE 563. Photogrammetry I (3)
Two hours of lecture and discussion, three hours of laboratory and discussion. Basic photogrammetric and photo interpretation concepts as a means of acquiring reliable data for engineering and management planning. Potentials, limitations, instrumentation and unique requirements are considered. Fall and Spring.
Prerequisite: ERE 371 or equivalent.

ERE 585. Microscopy and Photomicrography (3)
Two hours of lecture, one hour of demonstration, and three to five hours of laboratory. Principles of light microscopy and photomicrography with extensive laboratory practice. Introduction to scanning and transmission electron microscopy. Fall.
Prerequisite: Permission of the instructor.

ERE 596. Special Topics (1-3)
Lectures, conferences, discussions, and laboratory. Topics in environmental and resource engineering not covered in established courses. Designed for the beginning graduate student or selected upper division undergraduate. Fall and/or Spring.

ERE 642. Water Quality Modeling (3)
Two hours of lecture and three hours of laboratory per week. An analysis of the biological, chemical, and physical factors of receiving waters governing the action of wastes and their reactions in receiving waters. Introduction to modeling techniques applicable to water quality management issues. Fall.
Prerequisite: ERE 440 or equivalent as evaluated by the instructor.

ERE 643. Water Pollution Engineering (3)
Two hours of lecture and three hours of laboratory. Introduction to the physical, chemical, and biological parameters of waste water treatment processes and to the principles of the unit operations involved. Study of the design parameters and design procedures of waste water treatment systems. Spring.
Prerequisites: Physics and CHE 356 or permission of the instructor.
Note: A student may not enroll in or receive credit for both ERE 440 and ERE 643.

ERE 655. Infrared Remote Sensing Measurements (3)
Two hours of lecture comprising an in-depth coverage of the reflective and emissive properties of terrestrial materials in the near-, middle- and thermal-infrared regions of the electromagnetic spectrum. The relationship between factors related to natural resources and the upwelling radiance field will be discussed. Techniques for recording images of the earth in the near- to thermal-infrared region will be considered. This will include a discussion of sensing systems, the atmosphere and relevant optical principles. Focal plane array sensors will be discussed. Every third Fall.
Prerequisites: FEG 350 or FEG 352 or equivalent, at least three semesters of calculus, two semesters of physics.

ERE 656. Optical Remote Sensing Measurements (3)
Two hours of lecture comprising an in-depth coverage of the optical properties of terrestrial properties. The relationship between the radiance reflected from the earth's surface and factors related to natural resources will be considered. Techniques for recording images of the earth in reflected radiation in the 0.4 - 1.1 m region will be discussed. This will include an extensive review of the design principles of imaging sensors. Both digital and analog remote sensing devices will be covered. Optical and electronic design criteria will be covered, together with a discussion of data characteristics. Every third Fall.
Prerequisites: FEG 350 or FEG 352 or equivalent, at least three semesters of calculus, two semesters of physics.

ERE 657. Microwave Remote Sensing Measurements (3)
Three hours of lecture comprising a survey of the microwave emissivity and scattering cross section characteristics of a range of features. Techniques for imaging the earth in the microwave region of the electromagnetic spectrum will be discussed. This will include consideration of various ground-based and airborne radars and passive microwave scatterometers. Search and phased array radars will also be considered. Data analysis will be dealt with. Every third Fall.
Prerequisites: FEG 350 or 352 or equivalent, at least three semesters of calculus, two semesters of physics.

ERE 664. Photogrammetry II (3)
Two hours of lecture and three hours of laboratory. General analytic photogrammetry including interior and exterior orientation systems, intersection space resection and orientation. Correction of photo coordinates for film deformation, lens distortions, atmospheric refraction and earth curvature. Introduction to photogrammetric plotters. Planning photogrammetric projects, and designing optimum procedures for selected photogrammetric tasks. Fall.
Prerequisite: ERE 563 or equivalent.

ERE 670. Principles of Pulping and Bleaching (3)
Two hours of lecture and three hours of laboratory plus literature study of assigned topics, independent project planning and/or laboratory study. Discussion of pulping and bleaching processes. Effects of chemical and physical variables on the wood components and pulp properties; chemistry involved. Experiments in pulping and bleaching and pulp evaluation. Fall.
Prerequisites: Organic, physical, and analytic chemistry.
Note: A student may not enroll in or receive credit for both PSE 461 and ERE 670.

ERE 671. Chemistry of Pulping and Bleaching (3)
Three hours of lecture. Discussion of the chemistry underlying the commercial pulping and bleaching processes, designed to assist in interpreting the phenomena observed in these operations. Emphasis is placed on those reactions which contribute to delignification and the removal of chromophormic groups in lignin and extractives. Spring.
Prerequisite: FCH 572 or permission of the instructor.

ERE 675. Principles of Unit Operations (4)
Three hours of lecture and discussion and one two-hour computation period. Fundamentals of fluid dynamics, heat and mass transfer, appropriate analogies and process applications. Stage operations and computation methods. Application to distillation, extraction, gas absorption, evaporation, crystallization and drying. Design, operation, and computer simulation of equipment. Fall.
Prerequisites: Calculus and physical chemistry or permission of the instructor.

ERE 677. Paper Properties (4)
Three hours of lecture, three hours of laboratory, and discussion plus evaluation of literature, independent project planning and/or laboratory study. Evaluation and study of the physical, optical, and chemical properties of paper and the interrelationships existing between paper manufacturing methods, papermaking additives, test results and the ultimate properties desired in the finished paper. Fall.
Prerequisite: Permission of the instructor.
Note: A student may not enroll in or receive credit for both PSE 465 and ERE 677.

ERE 678. Paper Coating and Converting (2)
Two hours of lecture plus evaluation of literature, independent project planning, and/or laboratory study. Evaluation and study of the various coating materials and processes used by the paper industry. Introduction to polymers and their use in converting operations, fundamentals and parameters which control their use, effects on final properties of papers. Spring.
Prerequisite: PSE 465 or permission of the instructor.
Note: A student may not enroll in or receive credit for both PSE 466 and ERE 678.

ERE 682. Transport Processes (3)
Two hours of lecture and three hours of laboratory. The relationship between wood structure and wood permeability, moisture movement, and heat transfer. Fire retardant and wood preservation treatments. Wood drying. Unsteady-state transport processes. An advanced laboratory problem with report in wood-moisture relationships, wood drying, the relationship between wood permeability and treatability, or wood preservative treatments. Spring.
Prerequisite: Permission of the instructor.
Note: A student may enroll in or receive credit for WPE 326 and WPE 327 or ERE 682.

ERE 684. Mechanical Properties of Wood (3)
Two hours of lecture and three hours of laboratory. The effect of the anatomical and chemical nature of wood on its response to static and dynamic force systems. The theory of elasticity as applied to wood and wood-based composites. Spring.
Prerequisite: Permission of the instructor.

ERE 685. Transmission Electron Microscopy (5)
Two hours of lecture, two hours of laboratory/demonstration, minimum of ten hours of individual laboratory. The theory and operation of the transmission electron microscope including specimen preparation, photographic technique and interpretation of micrographs. Fall.
Prerequisite: Consultation with the instructor.

ERE 686. Wood—Water Relationships (3)
Two hours of lecture and three hours of laboratory. Relationship between wood moisture content and the environment, electrical and thermal properties, theories of moisture sorption, hygroscopic swelling and shrinking, thermodynamics of moisture sorption, mechanism of moisture movement as it relates to activation theory. Laboratory exercises will complement the theoretical topics discussed in the lecture. Fall.
Prerequisite: Permission of the instructor.

ERE 688. Tropical Timbers in Commerce (2)
Two hours of lecture. Introduction to the commercial use of tropical timbers; the factors of forest conditions, stand types and wood qualities influencing their utilization and the development of trade. Sources of information. Spring.
Prerequisite: Permission of the instructor.

ERE 689. Tropical Wood Anatomy (1)
Anatomical characters, identification and taxonomy of tropical woods important in commerce. Spring.
Prerequisite: WPE 386 or WPE 387. Recommended that ERE 688 be taken concurrently or previously.

ERE 691. Air Pollution Engineering (3)
Three hours of lecture and discussion. Study of the chemical, physical, and meteorological principles of air pollution and its control. Local and

global effects of air pollution. The atmospheric survey. Examination of the operating principles and design parameters of the various air pollution control systems. Air quality and emission standards. Fall.

Prerequisites: Physics and CHE 356 or permission of the instructor.

Note: A student may enroll in or receive credit for both ERE 441 and ERE 691.

ERE 760. Analytical Photogrammetry I (3)
Two hours of lecture and three hours of laboratory. Mathematical theory of photogrammetry including space resection, orientation, intersection and aerial triangulation. Spring.

Prerequisites: FEG 363, APM 360 and FEG 464 or equivalent.

ERE 762. Instrumental Photogrammetry I (3)
Two hours of lecture and three hours of laboratory. The theory and practice of extracting information from photographs with the aid of photogrammetric plotters. Fall or Spring.

Prerequisite: FEG 363 or equivalent.

ERE 775. Applied Thermodynamics (3)
The study and application of thermodynamics, including the first and second law, phase relationships, thermochemistry, the production of work and equilibrium relationships. Spring.

Prerequisites: FCH 360, FCH 361 or equivalent.

ERE 785. Scanning Electron Microscopy (5)
Two hours of lecture, demonstration and laboratory. Six hours of independent laboratory experience. The theory and operation of the scanning electron microscope including specimen preparation, photographic technique, and interpretation of micrographs. Spring.

Prerequisite: Permission of the instructor.

ERE 790. Advanced Image Analysis (3)
Two hours of lecture, plus laboratory. In this course, the acquisition of both analog and digital imagery will be considered. The relationship between the scene and the image will be considered as a precursor to digital image operations which may be performed to solve specific problems. Operations performed upon image planes to provide a two-dimensional image of use to the interpreter will be discussed. Various digital image analysis techniques will be covered. Fall or Spring.

Prerequisites: FEG 350 or 352 or equivalent, at least three semesters of calculus.

ERE 796. Advanced Topics (1-3)
Lectures, conferences, discussions, and laboratory. Advanced topics in Forest Engineering, Paper Science and Engineering, and Wood Products Engineering. Fall and/or Spring.

Prerequisite: Permission of the instructor.

ERE 797. Seminar (1-3)
I. Forest Engineering topics. II. Paper Science and Engineering topics. III. Wood Products Engineering topics. Fall and Spring.

ERE 798. Research in Environmental and Resource Engineering (Credit hours to be arranged)
I. Independent research topics in Forest Engineering. II. Independent research topics in Paper Science and Engineering. III. Independent research topics in Wood Products Engineering. Fall, Spring, and Summer.

ERE 899. Master's Thesis Research (Credit hours to be arranged)
Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

ERE 999. Doctoral Thesis Research (Credit hours to be arranged)
Research and independent study for the doctoral degree and dissertation. Fall, Spring, and Summer.

ESF—NONDEPARTMENTAL

ESF 332. Seminar for New Transfer Students (No Credit)
One hour of weekly lectures and discussions designed to introduce the transfer student to the College and its academic and social environs. Fall and Spring.

EST—ENVIRONMENTAL STUDIES

EST 300. Introduction to Environmental Studies (3)
Two hours of lecture and discussion and three hours of workshop per week. An introduction to the interrelationships among the natural environment, people, and the human environment. An experiential learning approach is used to develop critical facilities and systems thinking useful for assessing environmental issues. Fall.

EST 311. Natural Processes in Planning and Design (3)
Three hours of lecture and discussion per week. An overview presentation of the basic principles governing the dynamics of natural resources and processes and their implication for the planning, design, and management of natural and human environments. Sources and use of environmental data are discussed and illustrated. Occasional field trips may be required. A student may not receive credit for both EIN 311 and EST 311. Fall.

EST 321. Government and the Environment (3)
Three hours of lecture and discussion. An investigation of institutional influences on the American environment. Federal government and its role in environmental management and protection is emphasized. The pressures contributing to the formation of environmental policy are introduced. The practical consequences of this system are demonstrated through case studies. Fall.

EST 371. American Landscape History (3)
Three hours of lecture and discussion. The history of human-environment interaction in America since colonial times. Reviews the prevalent ideas and attitudes during various periods, and the development of the environmental professions. Uses a humanistic and ecological approach to understand the landscape in relation to changes in population, technology, economics, social organization, and attitudes. A student may not receive credit for both EIN 371 and EST 371. Spring.

EST 390. Social Processes and the Environment (3)
Three hours of lecture and discussion. A multidisciplinary social science perspective on the nature of the physical environment, particularly as it relates to the creation of human habitat. Human-environment interactions are viewed at three scales: (1) macro-interactions concerning social and economic issues; (2) meso-interactions concerning behavior of groups; (3) micro-interactions concerning perceptions and attitudes of individuals. Disciplines from which material may be drawn include: anthropology, ethology, geography, political science, psychology, and sociology. Spring.

EST 495. Selected Readings in Environmental Studies (1-3)
An in-depth and independent exploration of selected readings from the environmentally related literature. Emphasis is placed on gaining insights and understanding from the readings, rather than producing an extensive bibliography. Fall, Spring and Summer.

Prerequisite: Approval of study plan by the instructor.

EST 496. Special Topics in Environmental Studies (1-3)
Special topics of current interest to undergraduate students in Environmental Studies and related fields. A detailed course subject description will be presented as the topic area is identified and developed. Fall, Spring, and Summer.

Prerequisite: Permission of the instructor.

EST 498. Introductory Research Problems (1-3)
Guided individual study of an environmental topic. Emphasis is on the study procedure and the methods employed. Enrollment is possible at various times during the semester. Fall, Spring, and Summer.

Prerequisite: Approval of study plan by the instructor.

EST 499. Environmental Studies Internship (1-12)
Internships provide students with a supervised field experience to apply

and extend their academic abilities in a professional working environment. Enrollment is possible at various times during the semester. Fall, Spring, and Summer.

Prerequisite: Environmental Studies senior standing and written approval of an internship contract by major professor, curriculum director, and field supervisor.

FCH—FOREST CHEMISTRY

FCH 221. Organic Chemistry I (3)
Three hours of lecture. The structure, properties, and fundamental reactivity of organic compounds will be studied with emphasis on the reaction mechanisms and stereochemistry. In combination with FCH 223, this course provides a full survey of common classes of carbon compounds. Fall.

Prerequisites: One year of general chemistry.

FCH 222. Organic Chemistry Laboratory I (2)
One hour of pre-laboratory instruction. Three hours of laboratory. Laboratory safety. Melting and boiling points, distillation, recrystallization, thin-layer and column chromatography, and isolation of natural products. Qualitative functional group analysis. Fall.

FCH 223. Organic Chemistry II (3)
Three hours of lecture. The structure, properties, and fundamental reactivity of organic compounds will be studied with emphasis on the reaction mechanisms and stereochemistry. In combination with FCH 221, this course provides a full survey of common classes of carbon compounds. Spring.

Prerequisite: FCH 221 Organic Chemistry I or equivalent.

FCH 224. Organic Chemistry Laboratory II (2)
Four hours of laboratory including pre-laboratory instruction. Continuation of FCH 222. Simple physical and instrumental techniques applied to organic chemistry. Gas chromatography, polarimetry, kinetics. Introduction to classical literature syntheses. Spring.

Prerequisite: FCH 222 or equivalent.
Corequisite: FCH 223 or equivalent.

FCH 325. Organic Chemistry III (4)
Two hours of lecture, one six-hour laboratory. Classical and recent literature synthesis or organic compounds, employing advanced techniques. Fall.

Prerequisite: Two semesters of elementary organic chemistry.

FCH 360. Physical Chemistry I (3)
Three hours of lecture. Includes discussion on the properties of gases and liquids, laws of thermodynamics, solutions and colligative properties, and electrochemical cells. Fall.

Prerequisites: One year of college physics, differential and integral calculus.

FCH 361. Physical Chemistry II (3)
Three hours of lecture. Includes discussion on electrochemistry, principles of quantum mechanics, statistical mechanics, chemical kinetics, and basic spectroscopy. Spring.

Prerequisite: FCH 360 Physical Chemistry or the equivalent.

FCH 380. Instrumental Methods of Analysis (3)
Two hours of lecture and one three-hour laboratory. Lecture includes theory, applicability, and limitations of a number of current methods of instrumental analysis. Laboratory sessions provide practice with several of these techniques. Spring.

Prerequisites: General chemistry and quantitative analysis.

FCH 384. Spectrometric Identification of Organic Compounds (1-2)
Two hours of lecture and discussion. The first half semester (1 credit) will deal with common classes of organic compounds; the second half semester (1 credit) will deal with more complex structures. The use of complementary information from mass, infrared, nuclear magnetic resonance, and ultraviolet spectrometry will be applied to identification of organic natural products. Spring.

Prerequisites: Organic chemistry; one semester of advanced organic chemistry for second credit.

FCH 390. Drugs from the Wild (3)
Three hours of lecture and discussion each week. This course is designed to give students a comprehensive understanding of the variety of medicinal agents available from natural sources. Economic and societal aspects will be explored as well as scientific ones. In addition to curative agents, discussions will include toxic substances, folk medicinal (including herbal) preparations, and the so-called "recreational drugs."

Prerequisites: Introductory courses in chemistry and biology.

FCH 440. Introduction to Chemical Ecology (3)
Three hours of lecture with discussion. Centers on chemical signals among organisms from microbes to man as they affect ecology, physiology, and behavior and as they can be utilized for agriculture, pest management, and animal husbandry.

Prerequisites: Biology (one year), and organic chemistry (one year).
Note: Also listed as EFB 412.

FCH 495. Introduction to Professional Chemistry (1)
The professional chemist and his relationship with industry, government, and universities. Employment opportunities for the chemist, professional organizations, and unions will be discussed. The selection of a senior research topic and a literature survey will be required. Fall.

Prerequisite: Senior status.

FCH 496. Special Problems in Chemistry (1-3)
An opportunity for a special problem, technique development, independent or unstructured study in an area related to the chemical profession. The work may be technical, professional, or interdisciplinary. Advisors outside this department may be solicited. A brief proposal must be presented for approval with specific arrangements outlined including faculty advsior and objectives of the study. Evidence of competence and appropriate effort is required for credit. A written report will be expected. Fall and Spring.

Prerequisite: Upper division status.

FCH 497. Undergraduate Seminar (1)
One hour per week. Literature surveys and seminars on topics of current research interest and recent advances in chemistry. Spring.

FCH 498. Introduction to Research (5)
Eighteen hours of laboratory, library search and report writing. Solution of a selected research problem using special laboratory techniques. Typewritten report on data, procedures, results, and conclusions. Spring.

FCH 510. Environmental Chemistry I (3)
Three hours of lecture. Introduction to the processes that control chemical behavior in aquatic environments, including precipitation, gas exchange, acid-base, redox, complexation, and adsorption reactions. Emphasis will be on explanation and prediction of chemical behavior, using computer models where appropriate. Examples will be from the areas of water and wastewater treatment, pollutant fates and geochemistry. Fall.

Prerequisites: An introductory course in physical chemistry is required and a shortcourse in computer programming is recommended.

FCH 511. Environmental Chemistry II (3)
Three hours of lecture. Includes a detailed chemical explanation of current topics of concern in environmental chemistry and the chemistry of pollution. Lectures will cover topics relating to air, soil and biota pollutional impact. Spring.

Prerequisite: Chemistry through physical chemistry, or consent of the instructor.

FCH 515. Methods of Environmental Chemical Analysis (3)
One hour of lecture and six hours of laboratory. An introduction to sampling, analytical and quality control procedures necessary to obtain reliable water quality data. All analyses will be performed on a single aquatic system with the purpose of developing a final report characterizing the water quality of that system. Fall.

Prerequisite: A course in quantitative chemical analysis.

FCH 519. Environmental Chemistry Seminar (1)
One hour of lecture. Seminars on current research and issues in environmental chemistry and related areas. Spring.

FCH 520. Nuclear and Radiation Chemistry (2)
The two one-hour lectures will cover the information required for the basic understanding of nuclear reactions, the types of radiation emitted, the instrumentation necessary to detect and measure this radiation, the principles of radioisotope tracer techniques, and radiation chemistry which is the effect of radiation on organic systems. Visits to the Cornell Reactor and the Nuclear Medicine Department of the SUNY Health Science Center at Syracuse will be arranged. Spring.
Prerequisites: Physical, organic and inorganic chemistry or by permission of the instructor.
Note: This course can be taken independently of FCH 521.

FCH 521. Nuclear Chemical Techniques (1)
The laboratory will consist of one four-hour laboratory class every two weeks, with one hour to be made up at the student's discretion to accommodate counting periods which extend over several weeks. A short movie by the AEC each week will be required for the sixth hour. The laboratory will give each student the opportunity to use the individual counting instruments, gain experience in the handling and preparation of radioactive samples and the use of the 1000-curie-cobalt source in radiation chemistry. Spring.
Prerequisite: Physical, organic, and inorganic chemistry or permission of the instructor. Advanced tentative registration is required.
Co-requisite: FCH 520.

FCH 524. Topics in Natural Product Chemistry (3)
Three hours of lecture and discussion each week. A course intended to introduce the student to various types of secondary metabolites including several of past and current interest because of their pronounced biological activities. Modes of chemical reactivity and means of structure determination and syntheses are covered. Spring.

FCH 530. Biochemistry I (3)
Three hours of lecture. General biochemistry with emphasis on cellular constituents and metabolic reactions. The chemical, physical, and biological properties of amino acids, proteins, carbohydrates and their intermediary metabolism will be discussed. The chemistry of enzymes, energy transfers, and biological oxidations will also be covered. Fall.
Prerequisite: One year of organic chemistry.
Recommended: Physical chemistry.

FCH 531. Biochemistry Laboratory (2)
Six hours of laboratory. This course will stress techniques used in biochemical research. Techniques used include various types of chromatography, electrophoresis, spectrophotometry, and methods involved in the isolation, purification and assay of enzymes and nucleic acids. Fall.
Prerequisite: One semester of quantitative analysis with laboratory.

FCH 532. Biochemistry II (3)
Three hours of lecture. Topics discussed are: biosynthesis and degradation of amino acids and nucleic acids, protein biosynthesis, and an introduction to molecular biology. Spring.
Prerequisites: FCH 530 and its pre- and co-requisites.

FCH 550. Introduction to Polymer Science I: Polymer Synthesis and Mechanisms (3)
Three hours of lecture. Introduction to the synthesis of polymers and the mechanism of polymerization processes. Addition homopolymerization and copolymerization by radical, ionic and coordination type catalysts. Synthesis of block and graft copolymers. Stepwide polymerization, network formation and gelation. Structure of polymers and stereoregular polymerization. Degradation of polymers, reaction on polymers, polyelectrolytes. Fall.
Prerequisites: One year of organic chemistry and one year of physical chemistry.

FCH 551. Polymer Techniques (2)
One hour of lecture/discussion and three hours of laboratory; lab reports, final exam. Ten experiments covering the main topics of polymer synthesis (2), molecular weight determination (4), and characterization (4) are selected from free-radical solution and emulsion polymerizations, copolymerization, condensation polymerization, osmometry, viscometry, light scattering, gel permeation chromatography, polarized light microscopy, X-ray diffraction, differential scanning calorimetry, thermogravimetric analysis, stress-strain analysis, nuclear magnetic resonance. Fall.
Prerequisites: One year of organic and one year of physical chemistry.

FCH 552. Introduction to Polymer Science II: Polymer Properties and Technology (3)
Three hours of lecture. Introduction to the physical chemistry, physics, processing and technology of synthetic polymers. Polymer solutions, including molecular weight determinations and chain statistics. Polymer solid states, including rubber elasticity, viscoelasticity, the glassy state and the crystalline state. Properties, processing and technology of films, fibers, elastomers and foams. Spring.
Prerequisites: One year of organic chemistry and one year of physical chemistry.

FCH 560. Chromatography and Related Separation Sciences (3)
Three hours of lecture and discussion each week. A course designed to give the student a thorough understanding of analytical and isolation chemistry by modern chromatographic, distributive and molecular sieving techniques. The chemistry of the systems discussed will be stressed as well as the important physical aspects. Spring.
Prerequisites: Two semesters each of organic and general chemistry.

FCH 571. Wood Chemistry I: General Wood Chemistry (2)
Two hours of lectures. Introduction to carbohydrate chemistry. Chemistry of cellulose, hemicelluloses, and lignin. Cellulose derivatives. Distribution of polysaccharides and lignin in wood. Wood extractives. Chemistry of bark. Formation of heartwood. Wood as a chemical raw material. Fall.
Prerequisite: One or two semesters of a three-credit undergraduate course in organic chemistry.

FCH 572. Wood Chemistry II: Wood and Pulping Chemistry (3)
Three hours of lectures. Introduction to carbohydrate chemistry. Chemistry of cellulose, hemicelluloses, and lignin. Cellulose derivatives. Distribution of polysaccharides and lignin in wood. Wood extractives. Chemistry of bark. Formation of heartwood. Wood as a chemical raw material. Chemistry of the industrial pulping processes with emphasis on sulfite and kraft pulping of wood. Chemistry of the major bleaching agents. Chemical byproducts in the pulping industry. Complete tree utilization in the manufacture of pulp and paper. Fall.
Prerequisite: One or two semesters of a three-credit undergraduate course in organic chemistry.

FCH 573. Wood Chemistry III: Biosynthesis of Wood (2)
Two hours of lecture. Chemistry of pectin and starch. Photosynthesis with emphasis on the chemical phase. Chemistry of the primary cell wall in plants. Biosynthesis of cellulose, hemicelluloses, pectin, and starch. Biosynthesis of aromatics, including lignin. Biodegradation of wood. Spring.
Prerequisite: FCH 571 or an equivalent course in general wood chemistry.

FCH 630. Plant Biochemistry (3)
Three hours of lecture and discussion. Includes the biochemistry of photosynthetic electron transport and phosphorylation, photosynthetic carbon fixation, photorespiration, nitrogen fixation, nitrate reduction, photochrome, and plant hormones. The economic, ecological and environmental aspects of plant biochemistry will also be discussed. Spring.
Prerequisites: FCH 530-532 or FCH 539 or equivalent.

FCH 643. Chemical Activities of Microorganisms (3)
The microbial world. Intrinsic antigens, enzymes, and toxins. Overproduction of agonists, antagonists and semiochemicals. Selected elicitor-receptor interactions. Regulation of primary and secondary metabolite formation. General type reactions and bioconversions of steroids, vitamins,

nucleotides, and alkaloids. Applications of biocatalysis in semi-synthetic reaction pathways. Ancillary microbiological, genetic, biochemical, and processing technics.

Prerequisites: One year of organic chemistry and FCH 530, 539, or equivalent.

FCH 650. Physical Chemistry of Polymers I (3)

Three hours of lecture. Includes: thermodynamics of polymer solutions, phase equilibria, fractionation, structure-property relationships, elementary chain statistics, molecular geometry, network elasticity, polyelectrolyte theory, and viscocity. Fall.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

FCH 651. Physical Chemistry of Polymers II (3)

Three hours of lecture. Viscoelasticity. The glassy state and glass transition temperature. The crystalline state and crystalization kinetics. Characterization of structure and morphology of polymer solid states. Survey of structure and properties of native polymers. Spring.

Prerequisites: One year of organic and one year of physical chemistry.

FCH 652. Organic Chemistry of Polymers I (2)

Two hours of lecture. A broad survey of the chemistry of polyfunctional molecules and methods for their conversion to high molecular weight materials. Synthesis of a variety of specialty polymers and chemical reactions on natural and synthetic polymers. Some relations between molecular structure and useful properties. Fall.

Prerequisite: One year of organic chemistry.

FCH 653. Organic Chemistry of Polymers II (3)

Three hours of lecture. Kinetics and mechanism of polymerization processes, with emphasis on addition polymerization reactions initated by radical, cationic and anionic initators. Mechansim of sterospecific polymerization. Structure of polymers. Reactions on polymers and their modification for specific end uses. Block and graft polymers. Spring.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

FCH 796. Special Topics in Chemistry (1-3)
(Credit hours arranged according to nature of topic)

Lectures, conferences, and discussion. Advanced topics in physical chemistry, organic chemistry, or biochemistry. Fall and Spring.

FCH 798. Research in Chemistry
(Credit hours arranged according to nature of problem)

Independent research in physical and organic chemistry of synthetic polymers, physical and organic chemistry of natural polymers, organic chemistry of natural products, ecological chemistry and biochemistry. One typewritten report required. Fall, Spring, and Summer.

FCH 899. Master's Thesis Research
(Credit hours to be arranged)

Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

FCH 997. Seminar (1)

Seminars scheduled weekly; an average of twenty to thirty seminars are given annually. Discussion of recent advances in chemistry. Credit is given only once to a student. Fall and Spring.

FCH 999. Doctoral Thesis Research
(Credit hours to be arranged)

Research and independent study for the doctoral degree and dissertation. Fall, Spring, and Summer.

FEG—FOREST ENGINEERING

FEG 340. Engineering Hydrology, and Flow Controls (4)

Three hours of lecture and three hours of laboratory and discussion. Analysis of the waters of the earth, their occurrence, circulation, and distribution; physical properties and their interaction with their environment. Principles of hydrologic budgeting and routing; and basic hydraulics of open channel, conduit, groundwater and overland flow. Applications of probability as a basis for the design of solutions to groundwater, surface runoff, flooding and water supply problems. Spring.

Prerequisites: CIE 327, IOR 326, and APM 360.

FEG 350. Introduction to Remote Sensing for Engineers (2)

Two hours of lecture per week. The fundamentals of acquiring, analyzing, and utilizing remote sensing data in the performance of natural resource inventories, environmental quality surveys and site development analyses. Oriented for multidisciplinary participation.

Prerequisite: Junior standing.

FEG 352. Introduction to Remote Sensing (3)

Two hours of lecture and three hours of laboratory per week. Qualitative and quantitative introduction to the fundamentals of acquiring, analyzing, and utilizing remote sensing data in the performance of natural resource inventories, environmental quality surveys, site development studies, and land use analyses. Oriented for multidisciplinary participation. Fall and Spring.

Prerequisites: Junior standing, physics and calculus or consent of the instructor.

FEG 363. Photogrammetry I (3)

Two hours of lecture and discussion, three hours of laboratory. Basic photogrammetric and photo interpretation concepts as a means of acquiring reliable data for engineering and management planning. Potentials, limitations, instrumentation, and unique requirements are considered. Fall or Spring.

Prerequisite: ERE 371 or equivalent.

FEG 410. Structures (4)

Three hours of lecture, three hours of computation laboratory and discussion. Engineering principles in the analysis, planning design and construction of components and framed structures under various types of loadings. The proportioning of wood, steel and concrete members and the design of statically determinate structural systems. Emphasis is placed on the relationship between theoretical stress analysis and codes and specifications for appropriate materials and structural design practices. Fall.

Prerequisites: ERE 362, APL Computing.

FEG 420. Harvest Systems Analysis (1)

Three hours of discussion, demonstration and/or field exercises. An introduction to mensuration, harvesting operations, methods analysis, mechanization, and interrelationships between the production and silvicultural aspects of harvesting, is presented. A context is developed for the application of other Forest Engineering courses.

Prerequisites: FOR 321, ERE 362..

FEG 430. Engineering Decision Analysis (3)

An introduction to the design process as a decision model, with emphasis on determining economic attractiveness of engineering projects, and evaluation of investment alternatives. Analysis of production and construction activities in private and public works activities. Fall.

Prerequisite: IOR 326.

FEG 437. Transportation Systems (3)

Two hours of lecture and three hours of laboratory. Interrelationships between natural features, transportation types, design, and management objectives to provide the most effective system within a given framework. Basic engineering principles in the planning, location, design, construction, and maintenance of suitable transportation systems to serve various aspects of forest resource management.

Prerequisites: ERE 371, CIE 437, FEG 340.

FEG 448. Advanced Topics in Hydraulics (3)

Three hours of lecture per week. Classroom instruction and exercises introduce advanced concepts in hydraulics. Topics include the energy and momentum principles, critical flow, uniform flow, flow profiles, and unsteady flow, as appropriate. Suitable as an engineering design elective in the forest engineering curriculum. Fall.

Prerequisite: FEG 340 or equivalent as determined by the instructor.

FEG 454. Power Systems (2)
Two hours of lecture per week. Application of alternative technologies to the matching of power needs and resource constraints. Topics include tractive power, wind power, cogeneration, alternative fuels, and photovoltaics.
Prerequisites: MEE 285, ERE 351, FEG 420.

FEG 464. Photogrammetry II (3)
Two hours of lecture and three hours of laboratory. General analytic photogrammetry including interior and exterior orientation systems, intersection, space resection, and orientation. Correction of photo coordinates for film deformation, lens distortions, atmospheric refraction, and earth curvature. Introduction to photogrammetric plotters. Planning for photogrammetric projects and designing optimum procedures for selected photogrammetric tasks. Fall.
Prerequisite: FEG 363.

FEG 489. Forest Engineering Planning and Design (3)
Two hours of lecture and three hours of laboratory. A curriculum capstone course designed to integrate other coursework with a systematic approach to real life engineering problems. Semester-long laboratory projects are selected to provide experience in dealing not only with technical and economic constraints, but also with environmental, social, legal, and political aspects of the planning process. Spring.
Prerequisite: Senior standing in forest engineering.

FEG 498. Research Problem in Forest Engineering (1-3)
Independent research in topics in Forest Engineering for the highly motivated undergraduate student. Selection of subject area determined by the student in conference with appropriate faculty member. Tutorial conferences, discussions and critiques scheduled as necessary. Final written report required for departmental record. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor.

FOR—FORESTRY (RESOURCES MANAGEMENT)

FOR 205. Introduction to Macroeconomics (3)
Three hours of lecture per week. The role of macroeconomic theory in public policy will be emphasized. Basic macroeconomic models of the banking system and of the interplay of consumer, business firms and government purchases of goods and services will be used in the analysis of public policy with respect to stability of consumer prices and the level of employment in the economy, the role of foreign trade in the performance of the national economy.

FOR 206. Introduction to Microeconomics (3)
Three hours of lecture per week. Consumer behavior, pricing and resource allocation, and the theory of the firm and industry will be emphasized. The role of microeconomic theory in public policy analysis.

FOR 301. Field Dendrology (1)
Approximately one half-day lecture, five eight-hour field study, presented as the first portion of the Summer Program in Field Forestry held at Pack Demonstration Forest, Warrensburg, N.Y. Field identification and ecology of common woody species of the southeastern Adirondack area. Natural and cultural history of the area as it affects the growth and development of these species. Summer.

FOR 302. Forest Surveying and Cartography (2½)
Course consists of approximately thirteen, eight-hour class days, combining lectures and practical field applications. The course stresses development of functional ability in the areas of cartography, overland navigation, and land measurement. It is part of the Summer Program in Field Forestry held at Pack Demonstration Forest, Warrensburg, N.Y. Summer prerequisite for FOR 303, 322, 332.
Prerequisite: FOR 301.

FOR 303. Introduction to Forest Mensuration (3½)
Lecture and field practice on methods and procedures for measuring trees, forest stands, and forest products. Descriptive statistics and sampling are introduced as they relate to the measuring process. Emphasis is placed upon field procedures and performance. The course is part of the Summer Program in Field Forestry held at Pack Demonstration Forest, Warrensburg, N.Y. Summer.
Prerequisites: FOR 301 and FOR 302.

FOR 304. Introduction to Forestry (1)
Approximately one day of lecture and at least four all day field trips, presented as an integral part of the Summer Program in Field Forestry. Students will be introduced to the diversity of forestry and the activities of a professional forester, and will visit forestry field operations and wood-using industries. Summer.

FOR 305. Forestry Concepts and Applications (1)
Lectures and discussions will help students explore basic concepts of forestry, the breadth of and scope of forestry-related activity, and the diversity of forest values and uses. Topics include an introduction to many disciplines related to forest management and use, and study of how basic concepts from physical, biological, and social sciences are applied in forestry. Required of all forestry juniors.

FOR 307. Environmental Economics (3)
Three hours of lecture and discussion per week. Economic theory and analysis in the control of external economies and diseconomies in the use of resources. Particular emphasis is placed upon the study and application of economic models to the problems of pollution of air, water, and land. Relationships and interactions of the public and private sectors in the creation and control of externalities.

FOR 321. Forest Ecology and Silviculture (3)
Two hours of lecture and one three-hour field laboratory first half of semester; three hours of lecture last half of semester. Survey of forest tree and stand ecology and silviculture concepts and implications for treatment of forest stands for various values. Some field evaluation of forest stands, site and history variables, and treatment alternatives. For students outside Resources Management curriculum; not open to students taking FOR 332 and 334. Fall.
Prerequisite: Botany or general biology.

FOR 322. Forest Mensuration (1)
Lecture, field, and laboratory work blocked in time and subject matter with FOR 331 and 332. Principles and methods used in the measurement of the trees and forest stands, the use of aerial photos for mapping and inventory, and the theory and application of compound interest to forestry decisions. Fall.

FOR 331. Forest Influences (3)
Two lecture/discussion sessions and one laboratory/ field session per week. Forest vegetation as a modifier of the local fluxes of energy and water. Required for Resource Management juniors and Dual RM/Forest Biology students. Fall.

FOR 332. Silvics (3)
Three hours of lecture, or two hours of lecture with three hours of laboratory per week. Course stresses understanding of autecology and synecology as they apply to the creation of specific forest stand structures, dictated by varying management objectives (recreation, water, wildlife, wood).
Prerequisites: Botany and general ecology.
Corequisites: Soils, and forest influences (or equivalent prerequisites).

FOR 333. Silvics/Lab Practicum (1)
Five hours of field/laboratory exercise per week in selected weeks. Course stresses practical experience as a means to increase understanding and articulation of: 1) autecology and synecology, and 2) the creation of specific forest stand structures dictated by varying management objectives (recreation, water, wildlife, wood). Computer methods, problem analysis techniques, and a professional seminar are part of the practicum.
Prerequisites: Botany and general ecology.
Corequisites: Silvics, soils, and forest influences (or equivalent prerequisites).

FOR 334. Silviculture (4)
Three hours of lecture and 3½ hours of laboratory or field trip per week. Study of the practice of silviculture for managing forest stands to serve various interests of landowners. Field trips and exercises provide opportunities to see examples of common silvicultural methods under different management scenarios, and to learn and practice techniques for analyzing forest stands and developing prescriptions for their treatment. Fall.
Prerequisite: Concurrent or earlier courses in forest soils, forest influences, silvics, and forest mensuration, or equivalent.

FOR 335. Regional Silviculture (3)
Three hours of classroom study. Topics cover regional factors that influence silvicultural methods commonly used in different forest types. Provides study of various silvicultural systems used in operating forest properties in various regions, with attention to geographical differences in land use, market opportunities, species characteristics, and economic conditions. Spring.
Prerequisite: FOR 332 or FOR 321.

FOR 341. Watershed Hydrology and Water Quality (1-3)
One to three hours of lecture in classroom and field. Basic principles of watershed hydrology, natural water quality, and interactions between rural lands' management practices and water quality, especially the substantive basis underlying and best management practices for application of agricultural and silvicultural nonpoint sources on rural lands.
Prerequisite: Permission of the instructor.

FOR 345. Soils (3)
Two hours of lecture and three hours of laboratory. Introduction to the fundamentals of soil science with particular reference to forestry, but including other land uses. Fall.

FOR 360. Principles of Management (3)
Three hours of lecture and recitation. Basic principles and concepts of management which are universally applicable to any organization, business enterprise, or public agency. The various approaches to management including the classical, behavioral and quantitative concepts with emphasis upon the integrative approach, now required to meet modern society's changing life styles and values and the new awareness of the public regarding environmental matters and natural resources management. Spring.

FOR 361. Computing in Forestry (3)
Introduction to the use of the computer in forestry and to the BASIC programming language. Commonly used forestry techniques are implemented by the student on the computer and the student has the opportunity to use other professionally prepared programs. The student also uses the computer as a communication device. The course is designed for students in the forestry curriculum. Open to other students by permission of the instructor.
Prerequisite: An introductory course in computers.

FOR 364. Soil and Water Conservation Policy (3)
Three hours of lecture. An integrated, historical survey of water and related land resource conservation in the United States. Interrelationships of governments and private organizations in their functions of policy-setting and planning, administration of programs, and evaluation of projects. Three lectures per week. Spring.

FOR 370. Management of the Forest Enterprise (3)
Two hours of lecture and one hour of discussion and laboratory. This course is concerned with the management alternatives, both of a technical and social nature, that are available in the planning for and the production of timber, recreation, wildlife, forage, and water from the forest and with the criteria for choice to meet management objectives. Spring.

FOR 373. Timber Harvesting (3)
Two hours of lecture and one three-hour laboratory and discussion. Harvesting as a production system including equipment, equipment mixes, costs and manpower in serving and logmaking and primary and secondary transportation. Evaluation of various systems as to environmental impacts. Wood as a raw material to the primary processing system and trees as inputs to the harvesting system. Spring.

FOR 378. New York Forestry (3)
Lecture, discussion, and field trip. Historical development of forests and forest uses in New York, analysis of current issues in New York forestry, and consideration of possible future developments for New York forests. Provides information useful to geographers, foresters, planners, and others interested in the social environment of New York's natural resources.

FOR 400. Forest and Resource Economics (3)
Three hours of lecture/discussion per week. This course examines the applications of principles and models of economics to planning and management of forest and related natural resources. Applications to timber, wildlife, water, and outdoor recreation are stressed. Market and nonmarket analyses are covered.
Prerequisite: Senior status in forest resource management, open to others with permission of the instructor.

FOR 404. Economics of Wood-Using Industries (3)
Three hours of lecture and discussion. Structure and organization of selected wood-using industries. Analysis of decisionmaking by the firm. Principles of production and marketing including demand and cost analysis and pricing. Special issues and current problems of the industries, and introduction to the newer mathematical and statistical tools for meeting them. Spring.
Prerequisite: Microeconomics.

FOR 405. World Forestry Resources: Problems and Prospects (3)
Three hours of lecture and discussion plus guided readings, pertaining to world forest resources and the problems and opportunities associated with their use and development. Major topics include: world forest resources; production and trade; principal wood-producing countries; forestry and the problems of underdevelopment; and special areas and topics of interest to world forestry. Spring.
Prerequisite: Senior status preferred.

FOR 433. Commodity Production Silviculture (3)
Three hours per week of lecture and discussion stressing the development of prescriptions and the application of silvicultural techniques, primarily for commodity production. Topics include even-aged stand development, intermediate stand treatments, growth and change in uneven-aged stands, natural reproduction methods, assessing tree and stand quality and value, and application of selection system. Students undertake projects as a means for developing deeper understanding of and a capacity for prescribing different silvicultural techniques. Spring.
Prerequisites: FOR 334 and FOR 370, or equivalent. Senior standing required.

FOR 446. Forest Soil Classification, Survey, and Interpretation (3)
Three hours of lecture and discussion, one three-hour laboratory. Detailed examination of soil genesis and classification, and the survey and description of the soilscape. Interpretations are made for various land uses, especially forestry. Fall.
Prerequisites: FOR 331 or 345 or an introductory soils course.

FOR 455. Forest Tree Improvement (3)
Two hours of lecture, three hours of laboratory or field work. General principles and methods of tree improvement as practiced in this country and abroad. Tree selection techniques of vegetative propagation, hybridization, polyploidy, establishment and management of seed orchards, clonal and progency testing and other problems. Spring.
Prerequisites: FBL 470, or Introduction to Mendelian Genetics or Population Genetics.

FOR 461. Management Models (3)
Three hours of lecture. Introduction to the various models used in managerial decisionmaking. Emphasis is on the characteristics of the various models: their formulation, assumptions, uses, and limitations. The major topics covered will include: the role of models in management; simple optimization; constrained optimization; multi-valued choices; time adjustment of value; simulation; and models in nondeliberated decisions. Integration of the deliberative and intuitive models is stressed. Fall.

FOR 465. Natural Resources and Environmental Policy (3)
Three hours per week of lecture and discussion. Course examines the working principles creating the structure of natural resource and environmental policy. Specific laws and policies are analyzed as a product of complex history of policy processes spanning common law, legislation, administration, court decisions, local zoning, and economic relationships. Applies basic analytical skills to policy questions. Explores the relationship of the manager to policy processes. Required of seniors in Resources Management and of Environmental Studies students in the Policy and Management Study Area; open as an elective to other undergraduates.
Prerequisite: Senior status, one semester in both economics and U.S. government.

FOR 472. Fundamentals of Outdoor Recreation (3)
Three hours of lecture. Introduction to the programs and practices of federal, state, and local agencies and private organizations involved in planning, administration, and management of outdoor recreation areas. Emphasis is on major recreational issues and conflicts faced by area managers, and how they integrate solutions into their plans. Spring.

FOR 473. Planning and Development of Forest Recreation Areas (3)
Three hours of lectures or equivalent laboratory and assignments. Planning and designing forest recreation areas, structures, and facilities. Development of construction plans for camp and picnic sites, for waterfront areas and for trails. Emphasis is on the functional relationship between planning and design, management, and maintenance. Field trips required. Fall.
Prerequisite: FOR 472.

FOR 474. Commercial Recreation (3)
Three hours of lecture and discussion per week, plus one all-day field trip. Introduction to the role of the private sector in providing recreational facilities, programs, and services. Case studies of private recreation enterprises. Emphasis on the requirements for successful commercial recreation ventures. Fall.
Prerequisite: FOR 472 or equivalent.

FOR 475. Sociology and Psychology of Leisure Behavior (3)
Three hours of lecture and discussion. Introduction to theory and research findings dealing with the sociological and psychological aspects of leisure behavior; field work and lectures demonstrate applications, particularly with regard to leisure behavior. Spring.
Prerequisites: FOR 472, and an introductory course in sociology or psychology, or permission of the instructor.

FOR 477. Resource Policy and Management (3)
Three hours of lecture supplemented by one hour of discussion and/or lecture. Public and private forest policy formation; principles of modern management; overall management and operation of a productive forest property. Primarily for forest engineers. Not available to Resource Management undergraduates. Fall.
Prerequisites: Mensuration and silviculture, senior standing in Forest Engineering, or by permission of the instructor.

FOR 478. Wilderness and River Recreation Management (3)
Three hours of lecture and discussion per week. Introduction to the federal and state legislation and institutional framework that affects wilderness and river recreation planning and management. Emphasizes dispersed recreation planning, site management, visitor management, carrying capacity, and wilderness and river recreation management plans. One two-day field trip required. Spring (odd years).
Prerequisite: FOR 472 or equivalent.

FOR 480. Urban Forestry (3)
Two hours of lecture, and one hour of discussion or three hours of field study per week. Evaluation and management of urban greenspace resources, with emphasis on trees, in the context of other values and management processes in urban areas. Field practice in evaluating urban greenspace and tree resources. Shared resource course meeting with FOR 680 which has additional requirements. Spring.
Prerequisites: Senior status. FOR core courses or permission of the instructor for seniors in other programs.

FOR 496. Special Topics in Resource Management/Forestry (1-3)
Experimental and developmental courses in new areas of resource management/forestry or areas not covered in regularly scheduled courses. Topics may include but are not limted to the biological, physical, and social dimensions and the many and varied resources of forest lands and forestry. Specific detailed course descriptions for each course taught under the 496 designation are available for student perusal. Fall, Spring, and Summer.

FOR 498. Independent Study in Resource Management/Forestry (1-6)
Independent research or study in resource management/forestry for selected undergraduate students. Selection of subject area, nature of the research or study, and number of credit hours determined by student in conference with appropriate faculty member; initiative in taking FOR 498 rests with the student. Final written report is required for record. Fall, Spring, and Summer.
Prerequisite: Cumulative G.P.A. of at least 2.50 and approval of the advisor and instructor.

FOR 499. Independent Study/Internship in Resource Management/Forestry (7-12)
Independent research or study in resource management/forestry for selected undergraduate students especially designed for internships spent off-campus working for a resource management or forestry oriented firm or organization while also pursuing an academically oriented project. The selection of the study topic will be determined by the student in consultation with his/her advisor. Guidance will be provided by a faculty committee. Final written report is required for record. Limited to seniors in resource management/forestry. Fall, Spring, Summer.
Prerequisite: Must have a cumulative G.P.A. of at least 3.00.

FOR 520. Application of Ecology (3)
Two hours of lecture and discussion and one to three hours seminar, workshop, or field trip. Exploration of use and implications of ecological concepts for practices modifying terrestrial ecosystems for human benefit. Discussion of ecological writings in relation to applied problems; workshops, field trips, and student presentations exploring ecological implications of specific situations. Course designed for interdisciplinary participation. Spring (even years).

FOR 534. Greenspace Silviculture (3)
Two hours lecture; three hours field laboratory or two hours discussion per week. Concepts, techniques, and field practice of evaluating and managing vegetation systems, including site resources, woody and herbaceous vegetation, and use impacts, primarily for on-site, greenspace values on recreation, wildlife and multiple-use lands; roadsides and utility rights-of-way; buffer and protection areas, etc. Fall.
Prerequisites: Graduate status and coursework in silviculture and soils. Qualified seniors by permission of the instructor.

FOR 535. Advanced Forest Soils (3)
Three hours of lecture-discussions concerning the current state-of-the-art in forest soils. Effect of intensive forest management on soil, soil-site-species relationships, forest fertilization tree nutrition. Application of forest soils information to silviculture. Spring.
Prerequisite: FOR 331, 332 or beginning courses in soils and silviculture.

FOR 536. Forest Planting (3)
Two hours lecture and three hours laboratory or field average per week, including up to two all-day field trips. Concepts and techniques of forest planting for land rehabilitation and as a silvicultural system; including species and genetic selection, seed and plant production and evaluation, planting methods and site preparation, and regional case studies. Spring.
Prerequisites: Graduate status and coursework in silviculture. Qualified seniors by permission of the instructor.

FOR 540. Forest Hydrology (3)
Two hours of lecture and three hours of laboratory. The relation of forest and range vegetation to its environment, and its effect upon soil and water. Measurement of precipitation, runoff, erosion, and other variables. Fall.

FOR 542. Practice of Watershed Management (3)
Two hours of lecture and three hours of laboratory. The impact of the multiple use of forest and range lands on water yield and soil stability. Regional problems and potential solutions. Fall.
Prerequisite: FOR 540.

FOR 550. Environmental Impact: Principles and Strategies(3)
Three hours of lecture and discussion. Principles and theory of environmental impact and statements of impact as required by federal law. Administrative procedures for review and evaluation. Procedural strategy and effective constitution of statements for various governmental levels. Means of obtaining sources of authoritative information. Fall.
Prerequisite: Senior standing.

FOR 561. Land Use Economics (3)
Three hours of lecture/discussion per week. Study of the theory and method of land use economics and the application of economic analysis to open space and regional planning. Emphasis is on understanding basic concepts, development of operational methods and data sources. Case studies, outside readings, and guest speakers are utilized. Spring.
Prerequisite: One course in microeconomics.

FOR 562. International Timber Trade (3)
Three hours of lecture. Basic principles of international trade. Structure and procedures of international timber trade. Major trade regions and their relationships. Economic context of timber trade. Emphasis is placed upon methods of analyses for understanding both opportunities and limitations of timber products exports and imports. Fall.
Prerequisites: Two semesters of undergraduate economics, and senior standing in forestry or wood products engineering.

FOR 572. Outdoor Recreation Management (3)
Three hours of lectures per week. Description of specific methods and techniques used in outdoor recreation management. Discussion of practices applicable to resource, visitor, and service management. Spring.
Prerequisite: FOR 472, or equivalent.

FOR 587. Environmental Law (3)
Three hours of lecture and discussion. Studies in Environmental Law designed for resource managers. Review of structure and processes of American legal system, constitutional framework of environmental law, The National Environmental Policy Act, legal framework for management of federal lands, focus on legal aspects of common property resource management, land, water, and air. Fall.

FOR 588. The Law of Natural Resource Administration (3)
Three hours of lecture and discussion. An introduction to the law concerning the procedures, powers, and judicial review of public agencies responsible for the management of natural resources. Topics will include the extent of an agency's rule-making power and the rights of aggrieved parties to appeal from agency decisions. Spring.
Prerequisite: FOR 360 or equivalent course in public administration.

FOR 591. Oral Presentation Techniques (1)
Course meets one hour weekly for presentation and discussion. Course objective is improvement of presentation style and articulation skills through preparation, delivery, and interactive evaluation of information style seminars.
Prerequisite: Graduate standing and permission of the instructor.

FOR 592. Written and Oral Argumentation (2)
Course meets two hours weekly. Course objective is to improve articulation skills through effective argumentation. Students will participate in weekly discussions of the assigned readings, and each student will prepare, present, and support two position papers to a review panel consisting of students and faculty within the class.
Co- or *Prerequisite:* FOR 591 - Oral Presentation Techniques.

FOR 600. Field Applications in Forest Management and Operations (3)
Equivalent of three weeks of lectures, seminars, and field trips related to the management and utilization of the high value forest resources of the Allegheny Basin region. This course is the required entry point to the M.F. program and is taught during summer at the Allegany State Park near Salamanca, NY.
Prerequisite: Matriculation in the M.F. program—open to others by permission of the instructor.

FOR 601. Resource Information for Forest Management (3)
Three hours of lecture, discussion, or laboratory work per week. Introduces the student to the characterization of biophysical and socioeconomic resources, their inventory and compilation into a geographic information system as an application of database management, and their evaluation and analysis for incorporation into the forest management decisionmaking process.
Prerequisite: Matriculation in the M.F. program—open to others by permission of the instructor.

FOR 602. Forest Resource Economics (3)
Three hours of lecture, discussion, or laboratory work per week. Provides students with analytical tools in forestry economics for analyzing and evaluating forest management operations. Provides an understanding of the operation of the economic system within which forest resources are found.
Prerequisite: Matriculation in the M.F. program—open to others by permission of the instructor.

FOR 603. Advanced Silviculture (3)
Applications of basic principles and practices of silviculture within forest stands in accordance with and dictated by varying forest resource values and ownership objectives. Four hours of lecture and discussion per week for the first portion of semester, followed by six weekly hours of laboratory/field practicum thereafter. Field trips and lectures by guest experts. Several written and oral presentations required. Fall.
Prerequisite: Matriculation in the M.F. program—open to others by permission of the instructor.

FOR 604. Forest Policy (3)
Three hours per week of lecture, discussion, and recitation. Course content brings students to an advanced level of understanding of policies, the nature of issues, the institutional framework for policy evaluation. Emphasizes policy roles and functions in management, interrelationships, information resources, public input, and policy analysis for effective professional contributions in forest policy matters.
Prerequisite: Matriculation in the M.F. program—open to others by permission of the instructor.

FOR 605. Advanced Forest Management (3)
Equivalent of three credit hours per week of lecture and recitation. Provides students with the foundation necessary for the management and administration of a complex enterprise involving the use of forestland. Emphasizes the inherent multiresource nature of forest management; the diverse activities involved in producing outputs and services from forestland; and the managerial and technical skills required in planning, directing, and controlling those activities.
Prerequisite: Matriculation in the M.F. program—open to others by permission of the instructor.

FOR 606. Human and Organizational Behavior (3)
Three hours per week of lecture and recitation. Provides advanced students with knowledge of the interactions of individuals within organizational settings. Emphasizes the interdependency of people and organizational structures and requirements, and the role of management in facilitating harmonious mutual goal achievement. Deals with the nature and meaning of work, motivation, individual performance, job satisfaction, informal organizations, work environment, reward systems, controls, work stress.
Prerequisite: Matriculation in the M.F. program—open to others by permission of the instructor. Prior basic course in management principles highly desired.

FOR 610. Field Applications in Integrated Forest Management (3)
Two weeks of field trips, discussions, and problem analyses of operating forest systems in the Northeastern United States. Provides an intregation

and field application of material in the courses in the M.F. program.
Prerequisite: Matriculation in the M.F. program—open to others by permission of the instructor.

FOR 620. Silviculture Concepts and Applications (3)
Three hours per week of lecture and discussion stressing the conceptual basis for developing prescriptions and applying silvicultural techniques, primarily for commodity production. Topics include even-aged stand development, intermediate stand treatments, growth and change in uneven-aged stands, natural reproduction methods, assessing tree and stand quality and value, and application of selection system. Students undertake independent research projects as a means for developing deeper understanding of silvicultural concepts, and to improve their capacity for prescribing different silvicultural techniques. Spring.

FOR 625. Productivity of Forest Stands (3)
In two hours of lecture and three hours of laboratory, whole tree, stand, and forest community productivity are studied from an ecophysiological viewpoint. Quantitative techniques and methods used to evaluate biological as well as economic forest production are learned and utilized. From the perspective established, new trends and developments in silvicultural practice are critically examined. Spring.
Prerequisite: Permission of the instructor.

FOR 630. Tropical Forest Ecology and Land Use (2)
Two hours of lecture and discussion per week. Tropical forest environments and associated vegetation are studied from an ecological perspective and development options evaluated: agriculture, natural forest and plantation management, agroforestry, pasturing livestock, and forest preservation. Fall (even years).
Prerequisites: Coursework in ecology, soils, and silviculture is recommended, but not required.

FOR 635. Forest Soils and Their Analyses (3)
One hour of lecture, one hour of recitation, four hours of field and laboratory study of forest soils, emphasizing plant-soil relationships. Stress on quantification of plant-soil diagnostic techniques and their interpretation. Spring (odd years).
Prerequisites: FOR 446; background in physical and biological recommended.

FOR 640. Advanced Wildland Hydrology (3)
Lecture, discussion, and laboratory sessions in advanced problems of forest and range hydrology, watershed management methods, and techniques and evaluation of new methods of hydrologic data collection and analysis. Fall.
Prerequisite: SIL 540 or FEG 340.

FOR 642. Snow Hydrology (3)
Three one-hour lectures and two three-day field trips. Physical characteristics of snow and the energy relations important in its accumulation and dissipation. Problems of measurement and prediction of runoff and melt. Potentials for management. Spring.
Prerequisite: SIL 540 or FEG 340.

FOR 655. Advanced Forest Tree Improvement (3)
Two hours of lecture and discussion and three hours of laboratory. A study of advanced principles and techniques for genetic improvement of forest trees. Special emphasis is placed on selection and breeding for growth rates, wood quality, and insect and disease resistance. Problems of tree hybridization, racial variations, sexual reproduction, and quantitative genetics in forest trees. Laboratory training in pollen germination, vegetative propagation and other problems. Independent research problems will be undertaken by the student. Fall.
Prerequisites: FBL 470 and 471, FOR 455.

FOR 664. Soil and Water Conservation Policy (3)
One three-hour meeting per week. An integrated, historical survey of water and related land resource conservation in the United States. Interrelationships of governments and private organizations in their functions of policy-setting and planning, administration of programs, and evaluation of projects. Fall

FOR 665. Natural Resources and Environmental Policy (3)
Three hours per week of lecture and discussion. Course examines the working principles creating the structure of natural resource and environmental policy. Specific laws and policies are analyzed as a product of complex history of policy processes spanning common law, legislation, administration, court decisions, local zoning, and economic relationships. Applies basic analytical skills to policy questions. Explores the relationship of the manager to policy processes. Shares lecture with FOR 465, but has a separate discussion/seminar section and requires more in-depth readings and a policy analysis paper of a selected topic.
Prerequisite: Graduate status, one semester in both economics and U.S. government.

FOR 670. Resource Economics (3)
Three hours of lecture and discussion per week. Economic theory and analysis in resource management and use decisions. Study and application of economic models to land, water, forest, wildlife and recreational resources. Relationships and interactions of public and private sector in resource management. Fall.
Prerequisites: Two semester courses of undergraduate economics.

FOR 671. Economics of Nonmarket Goods (3)
Group discussion, lectures, guided readings, case studies, and student projects on the economic aspects of watershed management, fish and wildlife management, and outdoor recreation. Major topics include theories of valuation and application to nonmarket goods, cost analysis for nonmarket goods, and techniques for valuing nonmarket goods and services.
Prerequisites: FOR 670 or microeconomics or permission of the instructor.

FOR 672. Open Space Planning (3)
Three hours of lecture and discussion; one overnight field trip required. Study of methods and techniques applicable to open space planning in nonurban areas. Survey of literature and current research. Open space standards, classification systems, and inventory methods. Development of plans for large scale recreational areas, and inclusion of recreation into regional plans. The interrelationship and conflicts between resource utilization/development and recreation/aesthetics reviewed through case studies. Fall (odd years).

FOR 674. Commercial Recreation (3)
Three hours of lecture and discussion per week, plus one all-day field trip. Provides an overview of the private sector recreational facilities, programs, and services. Reviews the requirements for successful commercial recreation ventures. Quantitative analysis related to business feasibility is emphasized. Fall.
Prerequisite: FOR 472 or FOR 572 or equivalent.

FOR 675. Psychology of Leisure Behavior (3)
Three hours of lecture and discussion. Introduction to theory and research findings dealing with the sociological and psychological of leisure behavior: field work and lectures demonstrate applications, particularly in outdoor recreation. Fall.

FOR 676. Regional Development and Tourism (3)
Three hours of lecture/discussion per week. Study of the basic concepts of tourism as an important economic and social activity, and its place in regional resource development plans. Overnight field trip required. Spring (odd years).
Prerequisite: Permission of the instructor.

FOR 678. Wilderness and River Recreation Management (3)
Three hours of lecture and discussion per week. Reviews the institutional framework that affects wilderness and river recreation planning and management. Emphasis is on understanding management appropriate for dispersed recreational areas in forest and river environments and how planners and managers can use related research information. One two-day field trip required. Spring (odd years).
Prerequisite: FOR 472 or FOR 572 or equivalent.

FOR 680. Urban Forestry (3)
Two hours of lecture, and one hour of discussion or three hours of field study per week. Evaluation and management of urban greenspace resources, with emphasis on trees, in the context of other values and management processes in urban areas. Field practice in evaluating urban greenspace and tree resources. Shared resource course meeting with FOR 480, with additional requirements for FOR 680. Spring.
Prerequisites: Permission of the instructor.

FOR 691. Research and Evaluation Techniques in Recreation (2)
Two hours of lecture and discussion per week. An introduction to the design of research and evaluation projects to assist recreation planning and management in the public and private sectors. Emphasis is on understanding the process of design, measurement, and analysis to achieve effective techniques and applications in recreation. Spring (even years).
Prerequisite: Graduate status and previous recreation courses.

FOR 696. Special Topics in Forestry (1-3)
Experimental and developmental courses in new areas of forestry not covered in regularly scheduled courses. A course syllabus will be available to students and faculty advisors prior to registration.

FOR 697. Seminar (1)
Group discussion and individual conference concerning current topics, trends, and research in management. Fall and Spring.

FOR 735. Forest Soil Fertility (Applied Studies) (2-4)
Two hours of lecture and one hour of discussion. Up to six hours of laboratory depending on number of credit hours. Influence of soil fertility on development and growth of seedlings and trees, and techniques involved to determine this influence. Chemical and biological analysis to determine levels of soil fertility. Nutrient element deficiencies and their correction by soil amendments and fertilizers. Term projects by the student will be undertaken. Spring (even years).
Prerequisites: CHE 332 and 333, FBO 530, FOR 446 and FOR 635, or equivalent.

FOR 737. Forest Soil Physics (4)
Three hours of lecture and discussion and three hours of laboratory. Presentation of principles of soil physics including water flow, storage and availability, soil permeability, heat transfer, and their consideration as root environmental factors. Analytical procedures are introduced and evaluated. Applications of soil physics to silvics, soil fertility, watershed management and hydrology, soil biology, and land-use. Spring (odd years).
Prerequisites: FOR 345, 446, or their equivalents. Physical chemistry and integral calculus strongly recommended.

FOR 751. World Forestry (3)
Three hours of lecture and discussion. Worldwide forest classification and geographic distribution; comparative study of forest policies and management systems; tropical forestry and deforestation; agroforestry; international timber trade; forest resources and economic development; technology transfers; United States' role in less developed countries' forestry. Spring.

FOR 753. Resources Policy (3)
Three hours of lecture and seminar. Evaluation of basic environmental and resource issues and their evolvement in public and institutional policies. Exploration of alternative resource goals, policies, and program approaches and their implications. Analysis of processes for policy delineation and modification. Fall.

FOR 754. Advanced Forest Administration (3)
Critical appraisal of existing public, semipublic and private forest agencies in the United States, and the comparative study of major administrative organizations and practices. Occasional inspection trips to forestry headquarters and field units and discussion of internal administrative problems with forest officers. Fall or Spring.
Prerequisite: FOR 360 or equivalent.

FOR 796. Special Topics in Forest Resources Management (1-3)
Lectures, seminars, and discussion. Advanced topics in resource management and policy. Check schedule of classes for details of subject matter. Fall and/or Spring.

FOR 797. Seminar (1)
Individual presentation and group discussion concerning current topics of concern to natural resources or their management. Fall and Spring.

FOR 798. Research Problems in Forestry (1-6)
Special investigation and analysis of forest resource management topics. A study plan and a final written report are required. Fall and Spring.

FOR 895. Graduate Internship (1-6)
Professional experience which applies, enriches, or complements formal coursework. Restricted to Graduate students in Forest Resource Management. Graded on an "S/U" basis. Fall, Spring, and Summer.

FOR 898. Professional Experience (6-12)
Professional experience which applies, enriches, or complements formal coursework. Restricted to M.S. students in Option 2. Graded on an "S/U" basis. Fall, Spring, and Summer.

FOR 899. Master's Thesis or Project (1-6)
Investigation leading to the completion of a research-oriented thesis or to an application-oriented project. Graded on an "S/U" basis. Fall, Spring, and Summer.

FOR 999. Doctoral Thesis Research (1-12)
Investigation leading to the completion of the doctoral thesis. Graded on an "S/U" basis. Fall, Spring, and Summer.

FTC—FOREST TECHNOLOGY

FTC 200. Dendrology I (2)
Twenty-five hours of lecture and 34 hours of field time. A study of the distinguishing characteristics, growth features, distribution, associates and importance of the major tree species of North America. Seasonal field identification and on-the-spot discussion of habitats, associates, and the place in succession of the predominant forest trees and shrubs as found in the Adirondack area of the Northeast, plus a limited number of introduced species. Fall.

FTC 202. Plane Surveying I (4)
Sixty-eight hours of lecture and 76 hours of field and laboratory time. An introduction to the theory and practice of plane surveying. Emphasis is on individual skill development through small crew projects, handling typical surveying equipment in typical field situations. Lecture topics include the theory of measurements and errors, mathematics for plane surveying, introduction to field problems and introduction to map use and preparation. Field projects include traversing, using foresters' and engineers' tools and methods, mapping using field and office methods, and proficiency projects in handling typical surveying instruments. Fall.

FTC 203. Plane Surveying II (1)
Twelve hours of lecture and 32 hours of field time. A continuation of FTC 202 with emphasis on small crew field projects introducing the use of the engineer's level and the theodolite. Classroom work is directed at explaining the United States Public Land Survey system and introducing the concepts of modern deed descriptions and recordkeeping procedures. A trip to the County Court House is scheduled for a first hand look at a modern deed and recordkeeping operation. Spring.
Prerequisite: FTC 202.

FTC 204. Forest Mensuration and Statistics I (3½)
Sixty-nine hours of lecture and 46 hours of field and laboratory time. A classroom and field study of the basic principles and skills required for timber measurements. Volume tables, their use and construction, are studied. Cruise reports are required in which the student presents cruise

results. Various methods of forest sampling are studied, including methods of calculating necessary sampling intensities and sampling errors. Fall.

FTC 205. Forest Mensuration and Statistics II (2)
Four hours of lecture and 60 hours of field and laboratory time. A field problem of practical nature utilizing methods for collecting, analyzing, and presenting data dealing with timber volumes. Spring.
Prerequisite: FTC 204.

FTC 206. Forest Ecology (3)
Forty-eight hours of lecture and 52 hours of field time. Study of weather and weather data collection; students monitoring a forest weather station. Study of climate and soil factors, how they affect trees and forests and the interactions both within the forest community and within the forest ecosystem. Introduction to cover type mapping. Final field problem and written and oral report on the detailed analysis of a forest transect. Fall.

FTC 207. Aerial Photogrammetry (2)
Twenty-five hours of lecture and 44 hours of laboratory. Development of the ability to interpret important ground features by viewing aerial photos singly and in pairs, using stereoscopic techniques and equipment. Scale problems and the making of reliable horizontal and vertical measurements. Radial line plot control for the transfer of detail to base maps. Forest type mapping and forest mensuration using photos. Fall.

FTC 208. Allied Technologies (3)
Forty-nine hours of lecture and 54 hours of laboratory/field time. This is a multi-subject course. It provides the student with technical competence in the proper use, design, construction, and/or maintenance of personal computers, light wood frame construction, forest hand tools, maps and route surveys, trail development, and first aid and CPR. Fall.

FTC 209. Forest Roads (2)
Twenty-two hours of lecture and 34 hours of laboratory time. This course provides the student with the technical competence necessary to administer, locate, and design the construction and maintenance of a typical forest gravel road. Spring.
Prerequisite: FTC 202.

FTC 211. Silviculture I (2½)
Forty-one hours of lecture and 54 hours of laboratory. Lectures cover orientation, terminology and present a framework of the various treatments used in many common stand conditions to bring the forest into a more productive state in accord with the objectives of management. Emphasis on thinning in computer simulation and field practice. Exercises in planting and pruning. Demonstrations in chemical silviculture. Spring.
Prerequisite: FTC 206 Forest Ecology.

FTC 213. Forest Protection I (2)
Thirty-eight hours of lecture and 36 hours of laboratory/field time. A study of the insect and disease agents that damage trees and their role in the total forest community. The course covers identification of local forest insects and disease-causing organisms, study of the major pest groups of other forest regions, and control measures including the effects of pesticides on the environment. Field trips cover local pests and the damage caused, while laboratory work covers major groups of pests likely to be encounted elsewhere. Fall.

FTC 214. Personnel Management (1½)
Fourteen hours of lecture; 16 hours of laboratory time. A study of company and agency organization functions, including selection of and placement of personnel, training of personnel and performance evaluations, planning for and administering crew responsibilities, human relations in the working situation, and special personnel problems of the forest are covered. Techniques of foremanship are applied in various field exercises in other courses, along with the study of safety hazards, accident prevention, accident classification, and accident reporting. Spring.

FTC 215. Timber Harvesting (2)
Eighteen hours of lecture and 36 hours of field time. This course acquaints the student with the basic harvesting methods and techniques, with emphasis on the Northeast, along with the knowledge of how and where harvesting fits in with other forest uses. Students gain technical competence in timber sale contract administration and basic timber appraising. Spring.

FTC 217. Forest Management (3½)
Thirty-seven hours of lecture and 68 hours of lab and field work blocked with silviculture. Coverage of the common problems met in organizing a forest property to approach the goals of ownership. Study and practice in techniques of growth measurement and the gathering and use of forest records in general. Review actual examples and case studies of forest management and production activities. Summary application of pertinent information from many other courses in a work plan involving management decisions for an assigned forest property. Spring.
Prerequisite: FTC 206.

FTC 218. Forest Recreation (1½)
Fourteen hours of lecture and 32 hours of field/laboratory time. This course acquaints the student with the forest recreational resource, its present and future needs. Principles of recreational development and management are discussed with special emphasis placed on the technical aspects. Spring.

FTC 219. Elements of Wildlife Ecology (1½)
Twenty-four hours of lecture and four hours of field time. A study of the principles of wildlife ecology with fundamentals related to the actions of the preservationist, conservationist, and particularly those of the forest manager. Spring.

FTC 221. Soil/Water Measurements and Control (1½)
Fourteen hours of lecture and 28 hours of laboratory and field time. A basic introduction to precipitation and streamflow measurements taken at weather stations, snow courses, streamgaging stations, and other sample points. Includes field and lab measurements for determining physical properties of soils related to land management. Discusses forest management practices commonly used to control erosion and water quality. Spring.
Prerequisite: FTC 206 Forest Ecology.

FTC 223. Graphics (1)
Sixteen hours of lecture. An introduction to lettering and drafting with emphasis on the skills needed by the forest or surveying technician. Individual skill development is achieved through several projects. The concept behind each project is explained in handout material and lecture, and each student is then expected to complete the project on his/her own time. Freehand and mechanical lettering plates are produced in addition to precision and map drawings. Fall.

FTC 227. Forest Protection II (2)
Twenty-seven hours of lecture and 16 hours of field and laboratory time. The basic principles of fire ecology, forest fire behavior, fire danger and fire danger rating, forest fire prevention and control, and prescribed burning are covered. Handtool fire suppression techniques are demonstrated and practiced. Spring.
Prerequisite: FTC 213.

FTC 228. Structure and Growth of Trees (1½)
Seventeen hours of lecture and 12 hours of laboratory. A study of the various tissues of forest trees and how their growth and development are affected by internal and external factors. Differences in stem structures of some of the more important commercial tree species of the U.S. are studied in the laboratory and these differences are related to the commercial uses of these species. Spring.
Prerequisite: An introductory course in general botany or biology.

FTC 229. Silviculture II (2)
Twenty-six hours of lecture and 28 hours of field and laboratory. Continuation of FTC 211 dealing mainly with the handling of the more complex hardwood and mixed stands common to the Northeast. Special coverages will be offered on current practices of regional importance beyond the Northeast where graduates are likely to be employed. Spring.

FTC 230. Plane Surveying III (2)
Twenty-six hours of lecture and 28 hours of field time. A continuation of FTC 202 and FTC 203 with emphasis on small crew projects using

the theodolite. Advanced field techniques are discussed and practiced, such as the determination of the true-meridian by the method of direct solar observation, layout of highway curves and simple triangulation procedures. Each topic is developed in detail in the classroom before each field project is completed. Spring.

Prerequisites: FTC 202 and FTC 203.

FTC 298. Independent Study in Forest Technology (1-6)

Independent study in forest technology to apply, enhance, or supplement forest technology or related natural resource education. Objectives and scope of the project are negotiated in a learning contract between the student and instructor(s), with course admission based on permission of the instructor(s). Limited to those who have attended the complete regular SFT program, or those who have graduated from another forest technology program or a related natural resource program, or to students enrolled in any ESF program other than than of the SFT. A maximum of 6 credit hours may be taken by any student in total. Semesters as arranged. Fall, Spring, or Summer.

LIB—LIBRARY (COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY COURSE)

LIB 300. Library Research (1)

Fifteen hours of class time per semester (usually the first five weeks). Introduction for students at all levels to basic library material and the research process leading to preparation of a bibliography. Fall and Spring.

LSA—LANDSCAPE ARCHITECTURE

(See also courses listed under EIN and CMN.)

LSA 320. Introduction to Landscape Architecture and Planning (3)

Three hours of lecture. The course presents an overview of the professions of landscape architecture and planning. It surveys the historic and contemporary situations of environmental design and planning. The course introduces the socio-cultural and natural factors which influence the form and condition of the physical environment. It will introduce issues, personality, and projects. Fall.

LSA 326. Landscape Architecture Design Studio I (3)

Six hours of studio and one hour of lecture. The first in a sequence of studios focusing on the concepts, skills, and methods of design. This course introduces students to the basic vocabulary, concepts, and principles of design; the application and operation of these in the physical environment, development of three-dimensional spatial concepts. The requirements for this course include readings, examinations, field trips, design exercises, and projects. (Student field trip expense $125-$150.) Fall.

Prerequisite: Permission of the instructor.

LSA 327. Landscape Design Studio II (3)

One hour of lecture and six hours of studio. The second in a sequence of studios focusing on the concepts, skills, and methods of design. This course continues the development of design abilities through study of the interrelationship between the requirements of a design established in a program, the visual character of the site and the development of a designed result. The development of spatial concepts which meet principles of composition organization and a given set of requirements. The requirements for this course include readings, examinations, field trips, design exercises, and projects. (Student field trip expense $125-$150.) Spring.

Prerequisites: LSA 326, with a minimum grade of C, and CMN 382.

LSA 330. Site Research and Analysis (3)

One hour of lecture and three hours of studio per week. This course will require those enrolled to apply principles of natural resources and processes to assess the land use and development potentials and limitation of a site. The principles will include landforms, soils, hydrology, climate, energy, and plant, animal and human ecology. A variety of manual and computer techniques for data collection, analysis and synthesis of natural systems information will be explored. The course will concentrate on the comparison of synthesis techniques and their implications for land use and design decisionmaking. Occasional local field trips will be utilized. Spring.

Prerequisite: LSA 411 or permission of the instructor.

LSA 411. Natural Processes in Planning and Design (3)

Two hours and forty minutes of lecture per week. An overview of basic principles and processes of physical and biological landscape systems with respect to their roles in landscape design and planning. Emphasizes landform, soil, slope, hydrology, climate, energy, and general ecological issues as common elements influencing landscape design and the land use decisionmaking process. Sources and uses of environmental data are discussed. Fall.

LSA 422. Landscape Design Studio III (4)

Twelve hours of studio. This course is a continuation of skill development, theory, and strategies as they relate to design issues and process. Emphasis is placed on in-depth investigation on projects of a direct scale illustrating form derivation and the man-made and natural form. Occasional field trips to illustrate various design solution. Fall.

Prerequisites: LSA 327, with a minimum grade of C, and LSA 330.

LSA 423. Landscape Design Studio IV (4)

Twelve hours of studio. This course emphasizes skill development, theory, and strategy as they relate to large-scale site design situations. Continues prior courses' emphasis on design process and form manipulation. Occasional field trips to illustrate and inspect design form. Spring.

Prerequisite: LSA 422, with a minimum grade of C.

LSA 425. Orientation for Experiential Studio (2)

Three hours of lecture and recitation. Investigation and documentation of an area of specialty, discussion, readings, and research. Fall and Spring.

Prerequisite: Permission of the instructor.

LSA 433. Plant Materials (2)

Three hours of lecture and field work for first one-third of semester. Two hours of lecture for second one-third of semester. This course concentrates on woody plant materials used in landscape architecture, the ecological relationships of plants, ornamental plant materials use and identification, plant culture propagation, transplanting, planting plans and specifications. Fall.

Prerequisite: Permission of the instructor.

LSA 434. Design Materials (1)

Three hours of lecture for last one-third of a semester. An introduction to wood, concrete, masonry, asphalt, stone, and synthetic materials intended to provide students with an understanding of the basic visual, structural, and maintenance principles of each, in order to both use the materials in design and prepare written specifications. Fall.

LSA 442. Site Grading (2)

Two hours of lecture and three hours of studio during first two-thirds of semester. Lectures, projects, and assigned readings. The study of grading as the primary means of landform modification in landscape architectural design. Primary emphasis will be given to principles of grading, including contour manipulation, sections, profiles, and computations. Concepts of establishing acceptable slopes and positive surface drainage will be introduced. Enrollment limited to BLA or MLA students. Fall.

Prerequisite: LSA 330, Site Research and Analysis.

LSA 443. Site Drainage Systems (1)

Three hours of lecture for last one-third of semester. Lectures, projects, and assigned readings. Provides a basis for the design of drainage systems. Coverage includes concepts relevant to understanding precipitation, methods of run-off quantification, open channel flow, systematic pipe network analysis. Enrollment limited to BLA or MLA students. Fall.

Prerequisite: LSA 330, Site Research and Analysis.

LSA 444. Vehicular Circulation Design (1)

Three hours of lecture for first one-third of semester. Lectures, projects, and assigned readings. Must be taken concurrently with LSA 423. Introduces the circular geometry of horizontal curves and the parabolic geometry of vertical curves, curve coordination based on safety and

aesthetic relationships, road grading. Enrollment limited to BLA or MLA students. Spring.
Prerequisites: Computer programming and surveying.

LSA 445. Elements of Structures (1)
Three hours of lecture during the second one-third of the semester. Lectures, projects, and examinations. An introduction to the concepts of assembling engineering materials into structure. All common building systems will be surveyed and emphasis will be placed on fundamentals rather than on detailed mathematical design procedures.
Prerequisite: Non-Faculty of Landscape Architecture students by permission of the instructor. Not open to engineering majors. Spring.

LSA 455. Professional Practice in Landscape Architecture (2)
Two hours of lecture. This course examines the historic and contemporary modes of landscape architectural practice including practice types, ethics, operations, and client systems. Particular emphasis is given to the projected trends of professional practice and with impact on future roles for the landscape architect. Professional development is reviewed as it relates to internship, licensing, and continuing education. Occasional field trips will be utilized. Spring.
Prerequisites: Senior status in landscape architecture or permission of the instructor.

LSA 495. Selected Readings in Environmental Studies (1-3)
Exploration of selected readings in depth with individual independent study upon a plan submitted by the student and related to credit hours assigned. Upon approval of the instructor, the student may systematically investigate some subject area encountered in regularly scheduled courses or may initiate research on a variety of subject areas of determined relevance. Fall and Spring.
Prerequisite: Permission of the instructor.

LSA 496. Special Topics in Landscape Architecture (1-3)
One to three hours of class meetings. Special topics of current interest to undergraduate students in landscape architecture and related fields. A detailed course subject description will be presented as a topic areas is identified and developed. Fall and Spring.
Prerequisite: Permission of the instructor.

LSA 498. Introductory Research Problem (1-3)
Guided study of a selection of problems relating to landscape architecture and environmental design. Emphasis on study procedure and methods employed. Enrollment at periodic intervals throughout the semester. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor.

LSA 522. Landscape Design Studio VI (4)
Twelve hours of studio. Studio problems, research, drafting and field trips. Concentration on complex urban problems. Concern for social and psychological considerations of the individual and large groups of people, their interaction and resultant forms of the environment. Spring.
Prerequisite: Permission of the instructor.

LSA 524. Experiential Landscape Studio Design (16)
Forty-eight hours per week. The articulation of the study proposal established in LSA 425, as approved by faculty, through research, readings, field study with graphic and written documentation, and group discussion. Academic study in an off-campus location in an area of landscape architectural significance, as described and delineated in a student-prepared proposal approved by the faculty. Fall or Spring.
Prerequisites: LSA 425 and LSA 423, with a minimum grade of C.

LSA 525. Landscape Design Studio VI (4)
Twelve hours of studio. Investigation of a problem in landscape architecture as proposed by the student and conducted in conjunction with faculty advisor. Spring.
Prerequisite: Permission of the instructor.

LSA 527. Landscape Design Studio VI (4)
Twelve hours of studio. Studio problems, research, reports, and field trips. Concentration on regional landscape problems, the techniques of their analysis and derivation of their significance to the practice of landscape design. Spring.
Prerequisite: Permission of the instructor.

LSA 533. Plant Materials (2)
Field trips and discussion. Ornamental woody plant identification. Observation and sketches of outstanding examples of planting design. Two weeks. Summer.
Prerequisite: Permission of the instructor.

LSA 545. Professional Practice Studio (3)
Six hours of studio, one hour of recitation per week. Studio problems, research, discussion and recitation sessions on the processes and methods of office practice. Emphasis on all aspects of site development. Spring.
Prerequisite: Permission of the instructor.

LSA 595. Selected Readings in Landscape Architecture(1-3)
Exploration of selected readings in depth with individual independent study upon a plan submitted by the student and related to credit hours assigned. Upon approval of the instructor, the student may systematically investigate some subject area encountered in regularly scheduled courses or may initiate research on a variety of subject areas of determined relevance. Fall or Spring.
Prerequisite: Fifth-year status or permission of the instructor.

LSA 596. Special Topics in Landscape Architecture (1-3)
Experimental or special coursework in landscape architecture for graduate and undergraduate students. Subject matter and method of presentation vary from semester to semester. Fall and Spring.
Prerequisite: Permission of the instructor.

LSA 598. Research Problem (1-3)
Independent study of selected areas of environmental interest. Emphasis on a self-disciplined study, development of procedures and techniques to be employed in environmental design and planning. Engagement with specific sites and problems as proposed for study by individual communities. Enrollment at periodic intervals throughout the semester. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor.

LSA 600. Design Studio I (4)
Nine hours of studio and one hour of lecture/discussion per week. The first in a sequence of studios focusing on the concepts, skills, and methods of design. This course introduces students to the basic vocabulary of theoretical design principles, to the application and operation of these in the physical environment, and to the development of three-dimensional spatial concepts in community scale patterns. The requirements for the course include readings, examinations, field trips, design exercises, and projects. Fall.
Prerequisite: MLA status or permission of the instructor.

LSA 601. Design Studio II (4)
Five hours of studio and one hour of lecture per week. The second in a sequence of studios applying the concepts, skills, and methods of design in a critical analysis of various natural and human systems in community scale environments. Concentration is on the evaluation of options concerning a variety of land use activities, with special emphasis on landscape analysis and the functional and spatial quality of built environments. The requirements for this course include readings, examinations, field trips, design exercises, and projects. Spring.
Prerequisites: MLA status and LSA 600, CMN 552, or permission of the instructor.

LSA 611. Natural Factors Analysis (3)
Two hours and forty minutes of lecture and one hour of discussion per week. This course addresses basic principles and processes of physical landscape systems with respect to their roles in landscape design and planning. Sources and uses of environmental data are discussed and illustrated. An emphasis is placed on landform, soil, slope, hydrology, climate, and general ecological issues as common elements influencing landscape design and the land use decisionmaking process. Fall.
Prerequisite: MLA status or consent of the instructor.

LSA 615. Site Construction—Grading, Drainage and Road Layout (3)
One hour of lecture and six hours of studio per week. This course provides an introduction to important site construction basics, including landscape grading and landform manipulation to achieve appropriate slopes for use and positive surface drainage, principles of cut/fill analysis and subsurface drainage, horizontal and vertical alignment for road design, storm water management, and soil erosion control. Appropriate analysis methods and technologies will be employed through studio projects and exercises. Spring.
Prerequisite: MLA status, concurrent enrollment in LSA 601 or consent of the instructor.

LSA 620. Design Studio III—Advance Site Design (4)
One hour of lecture and nine hours of studio per week. This course is the third in a sequence of landscape architectural design studios. It focuses on advanced issues in site design and on the integration of project programming and design development into the design process. Concentrations include detailed designing for site layout, grading, storm water management, interior and exterior planting, site furnishing, and site lighting. Design exploration and project communication techniques are pursued such as CAD, reprographics, and computer-based visual simulation. Course requirements include readings, field trips, exercises, and design projects. Fall.
Prerequisites: MLA status, LSA 601, LSA 611, LSA 615, or consent of the instructor.

LSA 621. Design Studio IV—Community Design and Planning (4)
Nine hours of studio and one-hour of lecture/discussion per week. Design studio problems addressing principles and practice of community design, the structure and language of human settlements, community design process, natural systems and community design, and an introduction to the history, traditions and literature of the field. Spring.
Prerequisite: LSA 620 or consent of the instructor.

LSA 640. Research Methodology (3)
Three hours of lecture and discussion per week. This course focuses on the application of scholarly and scientific methodology to the activity of intellectual inquiry. The purpose is to enable students to identify researchable questions and introduce the methodology necessary to answer these questions in an unambiguous and objective manner. The course addresses issues of theory, research organization, experimental design, sampling theory, data manipulation, and communication with respect to proposals, projects, theses, and technical papers. Spring.
Prerequisite: Graduate standing or consent of the instructor.

LSA 650. Behavioral Factors of Community Design (3)
Three hours of lecture and discussion. An introduction to the contribution of the behavioral sciences to community design and planning is provided. Readings and discussions concern both theoretical and methodological aspects. Case studies are used to illustrate a variety of current behavioral science applications. Course assignments to familiarize the student with basic behavioral science methods including questionnaires, observations, and interviews. A final project provides an opportunity to synthesize course materials. Fall or Spring.
Prerequisite: MLA status or permission of the instructor.

LSA 652. Community Development and Planning Process (3)
Three hours of lecture per week. This course introduces planning and community development as connected, interdependent processes. Community dynamics, the participants in the planning and development processes, theories, principles and practices, and the role of design, will be explored. Lectures, seminars, guest speakers, research projects, readings, and discussion will be used to engage the course material. Fall.

LSA 653. Visual Landscape Analysis (2-3)
Three hours of lecture and discussion weekly during the first three quarters of the semester will cover aspects of landscape perception; introduction to methods of visual landscape inventory and evaluation, visibility determination, psychometric assessment, and visual impact assessment; and visual resource management strategies. Problems and exams will be required. Optional third credit entails four hours weekly of laboratory or field projects applying analysis methods and techniques during last quarter of semester.

LSA 654. Ecology in Landscape Design and Planning (3)
Three hours of lecture and discussion per week, with some Saturday field trips required. This course addresses methods of describing vegetative patterns in the landscape, emphasizing the processes that produce these patterns and the interactions that cause them to change. Familiarization with natural and cultural plant communities and the species that dominate their composition. The purpose is to identify the major biotic components that shape the ecological landscape, and relate them to pragmatic issues of land use, vegetation management, and landscape design. Fall.
Prerequisites: LSA 433, or LSA 533, or EFB 320, or EFB 578, or a dendrology course, or consent of the instructor.

LSA 655. Professional Practice for MLAs (4)
Two hours of lecture and six hours of studio per week. This course provides an overview of contemporary professional practice in public and private sectors, including steps in project implementation, familiarization with project management, marketing techniques, professional standards/conduct/registration, liability and ethics. Students will complete a set of typical construction documents in this course. Spring.
Prerequisite: MLA status or consent of the instructor.

LSA 671. History of Landscape Architecture (3)
Three hours of lecture-seminar. Regular use of slides and other projected lecture material; assigned texts as a basis for lecture; supplemental readings, assigned and individually researched; class discussion from readings and lecture; and student presentations and term paper. Historical study and style analysis of Western man's efforts to design his environment and his changing attitudes and relationships to environment. Also, non-Western coverage where significant or influential on Western man. Study of historical personalities as well as periods that are of environmental concern up into the modern periods. Fall.
Prerequisite: MLA standing or permission of the instructor.

LSA 696. Special Topics in Landscape Architecture (1-3)
Experimental or special coursework in landscape architecture for graduate and undergraduate students. Subject matter and method of presentation vary from semester to semester. Fall and Spring.
Prerequisite: Permission of the instructor.

LSA 697. Topics and Issues of Landscape Architecture (1)
Two hours of lecture and discussion every other week. Topics for discussion are selected to acquaint the entering graduate student with a generalized view and current issues facing landscape architects. Students are required to audit LSA 320 concurrently. Fall.
Prerequisite: MLA students or permission of the instructor.

LSA 699. Landscape Architecture Internship (1-12)
Internships provide students with a supervised field experience to apply and extend their academic abilities in a professional working environment. Enrollment is possible at various times during the semester. Fall, Spring, and Summer.
Prerequisite: Fast Track BLA/MLA status and written approval of an internship contract by major professor, curriculum director, and field supervisor.

LSA 700. Design Studio V—Integrative Studio (4)
One hour of lecture and nine hours of studio per week. This studio requires the integration of design/planning processes, research methods and information, and technical skills through focus on large-scale, community-based or multicommunity-based projects. Studio work will require individual and team work, as well as consideration of multidisciplinary contributions and interdisciplinary work. This studio is the final studio for all MLA students. Fall.
Prerequisites: LSA 600/601, LSA 620/621 or permission of the instructors.

LSA 752. Urban and Regional System Dynamics (3)
Lectures and workshop. The major concerns of this course are application of system dynamics; basic principles of system dynamics; and system dynamics modeling. This method is investigated as a useful tool in

modeling many landscape architectural and planning problems. No prior computer experience is necessary. Spring.
Prerequisite: Permission of the instructor.

LSA 796. Special Topics in Landscape Architecture (1-3)
One to three hours of class meetings. Special topics of current interest to graduate students in landscape architecture and related fields. A detailed course subject description will be presented as a topic area is identified and developed. Fall and Spring.
Prerequisite: Permission of the instructor.

LSA 798. Research Problem (Credit hours to be arranged according to nature of problem)
Special study of assigned problems relating to landscape architecture or planning, with emphasis on critical thinking. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor.

LSA 799. Thesis/Project (Internship) Proposal Development (1)
One hour of lecture/workshop per week. During this course, a student will prepare a proposal for a thesis/project in the MLA program. Spring or Fall.
Prerequisite: LSA 640 or permission of the instructor.

LSA 898. Professional Experience (1-12)
A supervised external professional work experience which satisfies Option 2 of the master's study integration requirement. Graded on an "P/F" basis. Fall, Spring, and Summer.
Prerequisite: Formation of committee, approval of proposed experience by committee, and the sponsor of the professional experience.

LSA 899. Master's Thesis Research (Credit hours to be arranged)
Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

PSE—PAPER SCIENCE AND ENGINEERING

PSE 300. Introduction to Papermaking (3)
Three hours of lecture. Historical and commercial consideration of the paper industry. Technology of papermaking with emphasis on stock furnish, stock preparation and paper machine operation. Introductory discussions of papermaking materials and formation and reactions of a fibrous web. Fall.

PSE 301. Pulp and Paper Processes (3)
Three hours of lecture. Technological consideration of pulping and bleaching of woody raw material. Includes consideration of wood procurement and preparation, pulping and bleaching processes, recovery of secondary fibers, pollution abatement and other ancillary operations. Spring.
Prerequisites: FCH 572, PSE 300 (or concurrent).

PSE 302. Pulp and Paper Processes Laboratory (1)
One three-hour laboratory. Study and practice in the techniques of laboratory procedures normally encountered in the pulp and paper industry. Laboratory exercises selecting and using standard testing methods. Field trips to observe commercial equipment of the pulp and paper industry. Spring.
Prerequisite: PSE 301 (or concurrent).

PSE 304. Mill Experience (2)
Twelve weeks full-time pulp or paper mill employment approved by the faculty between the junior and senior years. The student must submit a comprehensive report to fulfill this requirement. Summer.

PSE 361. Engineering Thermodynamics (3)
Principles of classical thermodynamics applied to engineering practice. First and second laws; heat effects; property functions and their correlation; physical and chemical equilibria; solutions and mixtures; power and refrigeration cycles. Thermodynamic analysis of processes and systems via case studies and computer simulation.
Prerequisites: Physics, calculus, PSE 370 and FCH 360 or equivalent.

PSE 370. Principles of Mass and Energy Balance (3)
Three hours of lecture. Conservation of mass and energy applied to steady-state and dynamic process units and systems. Problem analysis and solution; computational techniques. Thermodynamic data and their use; real vs. perfect gases; steam properties; psychrometry. Fall.
Prerequisites: Calculus, physics, and FCH 360 (or concurrent).

PSE 371. Fluid Mechanics (3)
Three hours of lecture and/or demonstrations. The study of momentum transfer. Steady and unsteady flow of liquids and gases in pipelines, ducts, open channels, and porous media. Movement of particles in fluid media. Newtonian and non-Newtonian flow and flow of suspensions. Filtration, sedimentation, centrifugation, agitation and mixing. Characteristics and selection of pumps, blowers, agitators and other equipment. Flow measurement and flow system design with economic considerations. Fall.
Prerequisites: College level physics and chemistry, calculus.

PSE 372. Heat Transfer (3)
Two hours of lecture and/or demonstration. The study of heat transfer including conduction, convection, radiation and their applications in industry. Heater and heat exchanger design and selection, and industrial evaporation. Spring.
Prerequisites: PSE 370 and 371 or equivalent.

PSE 456. Management in the Paper Industry Lecture Format with Seminars (3)
Provides the student with interactive contact with active executives in the paper and allied industries. The student will develop and present studies of business cases in discussion forum to the class. An understanding of how general managers operate to manage an entire organization will be presented by visiting experts, class participation, group presentations, written papers, and examinations.

PSE 461. Pulping Technology (3)
One hour of lecture and six hours of laboratory. Discussion of pulping and bleaching processes: effect of chemical and physical variables on the wood components and pulp properties; chemistry involved. Experiments in pulping and bleaching, and pulp evaluation. Fall.
Prerequisites: PSE 301, FCH 360 and FCH 361 or equivalent.
Note: A student may not enroll in or receive credit for both PSE 461 and ERE 671.

PSE 465. Paper Properties (4)
Three hours of lecture, three hours of laboratory and discussion. Evaluation and study of the physical, optical, and chemical properties of paper and the interrelationships existing between paper manufacturing methods, papermaking additives, test results and the ultimate properties desired in the finished paper. Fall.
Prerequisites: PSE 300 and PSE 301.
Note: A student may not enroll in or receive credit for both PSE 465 and ERE 677.

PSE 466. Paper Coating and Converting (2)
Two hours of lecture. Evaluation and study of various coating materials and processes used by the paper industry. Introduction to polymers and their use in converting operations. Study of materials and equipment used in converting operations, fundamentals and parameters which control their use, effects on final properties of papers. Spring.
Prerequisite: PSE 465.
Note: A student may not enroll in or receive credit for both PSE 466 and ERE 678.

PSE 467. Papermaking Wetend Chemistry (3)
Provides the student with the fundamental principles of Colloid and Surface Chemistry as they relate to the interaction of papermaking materials and chemical additives in the wetend of a papermachine system.

The topics of retention of fine solids and dewatering are addressed in detail. Application of the various topics presented during the course are made during a pilot papermachine trial.
Prerequisite: Senior standing in PSE program or consent of the instructor.

PSE 468. Papermaking Processes (3)
Two hours of lecture and three hours of laboratory. Study of the papermaking process, featuring operation of the pilot paper machine. Emphasis is on the fundamentals of stock preparation, paper machine operation, evaluation of the finished product and the collection and analysis of data to develop material and energy balance. Results of each paper machine run are evaluated in seminar-type discussions. Spring.
Prerequisites: PSE 461 and PSE 465.

PSE 473. Mass Transfer (3)
Three hours of lecture. The study of mass transfer, humidification, air conditioning, drying, gas absorption, distillation, leaching, washing, and extraction. Fall.
Prerequisites: PSE 370, 371, and 372 or equivalent.

PSE 477. Process Control (3)
Two hours lecture and discussion and one to three hours computer lab or field trip per week. Presents an introduction to the principles of process control. Linear analysis, LaPlace transforms, and nonlinear simulation are presented and applied to feedback, feedforward, cascade and adaptive control. Examples of process simulation, accuracy and stability of control are drawn from paper industry processes.
Prerequisite: Differential equations or consent of the instructor. Senior standing desirable.

PSE 480. Process and Plant Design I: Analysis (3)
Engineering analysis of modern plant practice in the pulp and paper, chemical and related industries. Operating costs, profitability criteria, optimization techniques and evaluation of alternatives. Modeling and computer simulation of process units and systems; use of typical software. Design exercises and case studies. Spring.

PSE 481. Process and Plant Design II: Synthesis (3)
Design-project procedure; data sources and development. Application of simulation and computer-aided design to process synthesis and plant layout. Formulation and solution of original design problems. Fall.
Prerequisite: PSE 480 or permission of the instructor.

PSE 491. Paper Science and Engineering Project I (1)
Student makes a systematic survey of all available literature on the problem assigned him and incorporates it in a formal, typewritten report. An essential part of this report is a detailed outline of a research project which the student may undertake during the next semester (PSE 492). Fall.
Prerequisites: PSE 300 and PSE 301.

PSE 492. Paper Science and Engineering Project II (3)
The analysis of a problem, the synthesis of a solution and the basic design of the facilities needed to solve a problem. Laboratory research, field work, and consulting as needed in addition to the literature survey completed in PSE 491. Progress reports and a final report and seminar-style presentation. Spring.
Prerequisite: PSE 491.

PSE 496. Special Topics (1-3)
Lectures, conferences, and discussions. Specialized topics in chemistry, chemical engineering, and physics as well as topics pertaining to management as related to the pulp, paper, paperboard, and allied industries. Fall and Spring.

PSE 498. Research Problem (1-4)
The student is assigned a research problem in pulping, bleaching, refining, additives, quality control of paper or paper products, or chemical engineering. The student must make a systematic survey of available literature on the assigned problem. Emphasis is on application of correct research technique rather than on the results of commercial importance. The information obtained from the literature survey, along with the data developed as a result of the investigation, is to be presented s a technical report. Fall, Spring, and Summer.
Prerequisites: PSE 461 and PSE 465.

WPE—WOOD PRODUCTS ENGINEERING

WPE 300. Properties of Wood for Designers (2)
Two hours of lecture. An introduction to the basic structure and properties of wood for the designer. Discussion of the effects of wood structure and properties on practical woodworking techniques. Fall.

WPE 326. Fluid Treatments (2)
Two hours of lecture. An introduction to wood-moisture relationships, wood permeability and pressure treatments, thermal conductivity, water-vapor movement, and drying and fire retardancy. The flow of fluids, heat and water vapor are treated as analogous phenomena and are related to the cellular structure of wood. Unsteady-state flow of gases, heat and water vapor are introduced. Spring.

WPE 327. Fluid Treatments Laboratory (1)
Three hours of laboratory. Laboratory studies in relative humidity measurement, wood-moisture relationships, the relationship between permeability and treatability, wood-preservative treatments, wood drying and flame testing. Spring.
Prerequisite: WPE 326 (or concurrent).

WPE 330. Building Codes and Zoning Practices (3)
This course shall introduce the student to the New York State Building Code and local fire, zoning and administrative ordinances pertaining to the construction and maintenance of buildings. The student shall be introduced to building system classification; systems components including mechanical, electrical, fire, and structural elements; and the need for safety regulations governing construction and occupancy of buildings. Emphasis shall be placed on construction plans review and code enforcement administration. Fall or Spring.

WPE 332. Mechanical and Electrical Equipment (3)
This course shall introduce the basic concepts of mechanical systems design and construction for residential and commercial buildings. Systems design and equipment selection are performed for heating, cooling, plumbing, sanitation, electrical, lighting, and acoustics. Emphasis is placed on the use of the New York State Building Code, the New York State Energy Conservation Code, the National Electrical Code, and the American Society of Heating, Refrigeration and Air Conditioning Engineering Manual. Fall or Spring.

WPE 335. Cost Engineering (3)
Methods and procedures for monitoring, analyzing, forecasting, and controlling construction project costs. Project cost control systems. Productivity. Comparative cost evaluation of alternatives in construction methods and equipment. Life-cycle costing. Capital, operating, and equipment costs. Inflation and cost escalation. Cost and bidding models. Linear programming applications. Fall.

WPE 342. Light Construction (3)
Three hours of lecture. Elements of structural design, light-frame construction, blueprint reading, and estimating. Fall.

WPE 343. Construction Estimating (3)
Introduction to construction estimating by the quantity takeoff method. Residential and commercial estimates shall be performed by the student using Walker and Means references. The student shall be introduced to the use of spreadsheet and estimating software for construction estimate preparation. Fall or Spring.
Prerequisite: WPE 342.

WPE 350. Construction Methods and Equipment (3)
Major operations comprising construction projects: excavation and fill, concrete, structural steel, welding, masonry, and bituminous operations.

Calculating equipment production, planning the project, and deciphering the contract drawings and specifications. Spring.
Prerequisite: Statics (WPE 361, MEE 221, or equivalent).

WPE 361. Engineering Mechanics—Statics (3)
Three hours of lecture. Forces and vectors, moments, equivalent force systems, free bodies, structures, section properties. Fall.
Prerequisites: Integral calculus and general physics.

WPE 386. Structure and Properties of Wood (2)
Two hours of lecture. Structure of wood in relation to defects, properties and uses. The variability of wood. Spring.

WPE 387. Wood Structure and Properties (3)
Three hours of lecture. Structure of wood and its relation to physical properties and uses. The normal variability of wood, abnormal growth, defects, deterioration of wood and their influence on properties and uses. Fall.

WPE 388. Wood and Fiber Identification Laboratory (2)
Six hours of laboratory. Wood and papermaking fiber identification using both gross and microscopic features. Fall.
Prerequisite: WPE 387 to be taken concurrently or previously.

WPE 389. Wood Identification Laboratory (1)
Three hours of laboratory. Identification of principal commercial timbers of United States on gross characteristics. Spring.
Prerequisite: WPE 387.

WPE 390. Fiber Identification Laboratory (1)
Three hours of laboratory. Identification of woody and nonwoody papermaking fibers. Spring.
Prerequisite: WPE 387.

WPE 399. Field Trip (1)
One week immediately following the spring semester supervised study and reporting of representative wood products industries and construction sites. Required of all students in WPE. Estimated individual expenses are about $350 while on the trip.

WPE 400. Introduction to Forest Products (3)
Three hours of lecture. Characteristics of the products of the forest tree and manufacture of wood products. Spring.

WPE 401. Creative Approaches to Management (3)
Three hours of lecture and recitation with a workshop/seminar emphasis. Provides practical guidelines for dealing effectively with modern managerial problems that require new thinking. This course uses relevant, real-life examples, practical applications, and develops creative approaches. It is designed for individuals who intend to or are engaged in managing people and activities in achieving both organizational and personal goals. Spring.

WPE 404. Timber Design Project (3)
Lectures, discussion, and laboratory. Mechanical testing of wood, development of working stresses, design of a model structure, and construction and testing of the structure. Spring.
Prerequisites: Mechanics of materials and senior standing or permission of the instructor (ERE 362, CIE 325, or equivalent).

WPE 413. Computer-Aided Senior Project (3)
Open-ended real life design projects with microcomputer aids. Systems approach is emphasized. Project requirements, system selection, approximate design, value engineering, and final design are among design aspects considered. Analytical and model analysis. Spring.
Prerequisite: FEG 410 or equivalent.

WPE 414. Computer Applications in Engineering (3)
Microcomputer applications in a broad spectrum of selected topics in engineering sciences and practice. Hands-on experience is emphasized. Coursework is directed towards solving real life engineering problems. Software are provided and used. No computer programming or skills are required. Spring.
Prerequisite: FEG 410 or equivalent.

WPE 420. Adhesives, Sealants, and Coatings (3)
Two hours of lecture and three hours of laboratory. An introduction to adhesives, sealants, and coatings used in the wood products and building construction industries. All three types of materials, based upon polymers, will be evaluated in terms of their properties and respective technologies. Emphasis will be placed on knowing how to apply this knowledge to understand current practice and problem solving. Laboratory demonstrations to identify materials, methods of application, and methods of evaluating these materials. Fall.
Prerequisite: Junior standing.

WPE 422. Composite Materials (3)
Two hours of lecture and three hours of laboratory. Manufacturing methods, physical and mechanical properties, and major uses of each of the following products will be examined—decorative plywood, construction and industrial plywood, particleboards, waferboards, fiberboards, laminated beams, laminated-veneer lumber, wood polymer composites, and overlays. Laboratory exercises will be patterned after ASTM standard tests to evaluate the physical and mechanical properties of these materials with written reports to be submitted by each student. Spring.
Prerequisites: WPE 420. Concurrent or prior registration in ERE 362.

WPE 453: Construction Planning and Scheduling (3)
Methods and concepts for planning and scheduling of operations and resources on construction projects. Topics include Gantt charts, progress curves, critical path methods, and project networking techniques. Microcomputer applications. Fall.

WPE 454. Construction Project Management (3)
Techniques of managing a construction project: Estimating, CPM scheduling, field administration, quality control, contract law, labor relations, safety. Spring.
Prerequisite: WPE 350.

WPE 455. Construction Contracts and Specifications (3)
Introduction of the types of contracts used in the construction industry. Analysis of the contractor's, designer's, and owner's duties and obligations as determined by the construction contract documents. Study of concepts, language, formats, and procedures for project manual organization practice and the general conditions of the contract for construction. Spring.

WPE 497. Senior Seminar for Wood Products Engineering Majors (2)
Discussion and assigned reports in current problems and new developments in Wood Products Engineering. Fall.

WPE 498. Research or Design Problem (1-3)
Conferences, library, laboratory and/or field research on a specific problem in Wood Products Engineering. Typewritten report (original and one copy) required. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor and advisor.

State University of New York

STATE UNIVERSITY OF NEW YORK

State University's 64 geographically dispersed campuses bring educational opportunity within commuting distance of virtually all New York citizens and comprise the nation's largest, centrally managed system of public higher education.

When founded in 1948, the University consolidated 29 State-operated, but unaffiliated, institutions. In response to need, the University has grown to a point where its impact is felt educationally, culturally, and economically the length and breadth of the state.

Nearly 379,000 students are pursuing traditional study in classrooms or are working at home, at their own pace, through such innovative institutions as Empire State College, whose students follow individualized and often nontraditional paths to a degree. Of the total enrollment, more than 100,000 students are 24 years or older, reflecting State University's services to specific constituencies, such as refresher courses for the professional community, continuing education opportunities for returning service personnel, and personal enrichment for more mature persons.

State University's research contributions are helping to solve some of modern society's most urgent problems. It was a State University scientist who first warned the world of potentially harmful mercury deposits in canned fish, and another who made the connection between automobile and industrial exhaust combining to cause changes in weather patterns. Other University researchers continue important studies in such wide-ranging areas as immunology, marine biology, sickle-cell anemia, and organ transplantation.

More than 1,000 Public Service activities are currently being pursued on State University campuses. Examples of these efforts include special training courses for local government personnel, State civil service personnel, and the unemployed; participation by campus personnel in joint community planning or project work, and campus-community arrangements for community use of campus facilities.

A distinguished faculty includes nationally and internationally recognized figures in all the major disciplines. Their efforts are recognized each year in the form of such prestigious awards as Fulbright-Hays, Guggenheim, and Danforth Fellowships.

The University offers a wide diversity of what are considered the more conventional career fields, such as business, engineering, medicine, teaching, literature, dairy farming, medical technology, accounting, social work, forestry, and automotive technology. Additionally, its responsiveness to progress in all areas of learning and to tomorrow's developing societal needs has resulted in concentrations which include pollution, urban studies, computer science, immunology, preservation of national resources, and microbiology.

SUNY programs for the educationally and economically disadvantaged have become models for delivering better learning opportunities to a once-forgotten segment of society. Educational Opportunity Centers offer high school equivalency and college preparatory courses to provide young people and adults with the opportunity to begin college or to learn marketable skills. In addition, campus based Educational Opportunity Programs provide counseling, developmental education and financial aid to disadvantage students in traditional degree programs.

Overall, at its EOC's, two-year college, four-year campuses and university and medical centers, the University offers 3,600 academic programs. Degree opportunities range from two-year associate programs to doctoral studies offered at 12 senior campuses.

The 30 two-year community colleges operating under the program of State University play a unique role in the expansion of educational opportunity. They provide local industry with trained technicians in a wide variety of occupational curriculums, and offer transfer options to students who wish to go on and earn advanced degrees.

The University passed a major milestone in 1985 when it graduated its one-millionth alumnus. The majority of SUNY graduates pursue careers in communities across the State.

State University is governed by a Board of Trustees, appointed by the Governor, which directly determines the policies to be followed by the 34 State-supported campuses. Community colleges have their own local boards of trustees whose relationship to the SUNY board is defined by law. The State contributes one-third to 40 percent of their operating cost and one-half of their capital costs.

The State University motto is: "To Learn—To Search—To Serve."

STATE UNIVERSITY OF NEW YORK

UNIVERSITY CENTERS

State University of New York at Albany
State University of New York at Binghamton
State University of New York at Buffalo
State University of New York at Stony Brook

COLLEGES OF ARTS AND SCIENCE

State University College at Brockport
State University College at Buffalo
State University College at Cortland
State University of New York Empire State College
State University College at Fredonia
State University College at Geneseo
State University College at New Paltz
State University College at Old Westbury
State University College at Oneonta
State University College at Oswego
State University College at Plattsburgh
State University College at Potsdam
State University College at Purchase

COLLEGES AND CENTERS FOR THE HEALTH SCIENCES

State University of New York Health Science Center at Brooklyn
State University of New York Health Science Center at Syracuse
State University of New York College of Optometry at New York City
(Health Sciences Center at SUNY at Buffalo)*
(Health Sciences Center at SUNY at Stony Brook)*

COLLEGES OF TECHNOLOGY and COLLEGES OF AGRICULTURE AND TECHNOLOGY

State University of New York College of Technology at Alfred
State University of New York College of Technology at Canton
State University of New York College of Agriculture and Technology at Cobleskill
State University of New York College of Technology at Delhi
State University of New York College of Technology at Farmingdale
State University of New York College of Agriculture and Technology at Morrisville
State University of New York College of Technology at Utica/Rome** (Upper-division and master's programs)
(Fashion Institute of Technology at New York City)***

SPECIALIZED COLLEGES

State University of New York College of Environmental Science and Forestry at Syracuse
State University of New York Maritime College at Fort Schuyler

STATUTORY COLLEGES****

NYS College of Agriculture and Life Sciences at Cornell University
NYS College of Ceramics at Alfred University
NYS College of Human Ecology at Cornell University
NYS School of Industrial and Labor Relations at Cornell University
NYS College of Veterinary Medicine at Cornell University

COMMUNITY COLLEGES

(Locally-sponsored, two-year colleges under the program of State University)

Adirondack Community College at Glens Falls
Broome Community College at Binghamton
Cayuga County Community College at Auburn
Clinton Community College at Plattsburgh
Columbia-Greene Community College at Hudson
Community College of the Finger Lakes at Canandaigua
Corning Community College at Corning
Dutchess Community College at Poughkeepsie
Erie Community College at Williamsville, Buffalo and Orchard Park
Fashion Institute of Technology at New York City***
Fulton-Montgomery Community College at Johnstown
Genesee Community College at Batavia
Herkimer County Community College at Herkimer
Hudson Valley Community College at Troy
Jamestown Community College at Jamestown
Jefferson Community College at Watertown
Mohawk Valley Community College at Utica
Monroe Community College at Rochester
Nassau Community College at Garden City
Niagara County Community College at Sanborn
North Country Community College at Saranac Lake
Onondaga Community College at Syracuse
Orange County Community College at Middletown
Rockland Community College at Suffern
Schenectady County Community College at Schenectady
Suffolk County Community College at Selden, Riverhead and Brentwood
Sullivan County Community College at Loch Sheldrake
Tompkins Cortland Community College at Dryden
Ulster County Community College at Stone Ridge
Westchester Community College at Valhalla

*The Health Sciences Centers at Buffalo and Stony Brook are operated under the administration of their respective University Centers.

**This is an upper-division institution authorized to offer baccalaureate and master's degree programs.

***While authorized to offer such baccalaureate and master's degree programs as may be approved pursuant to the provisions of the Master Plan, in addition to the associate degree, the Fashion Institute of Technology is financed and administered in the manner provided for community colleges.

****These operate as "contract colleges" on the campuses of independent universities.

College of Environmental Science and Forestry

COLLEGE ADMINISTRATION

President .... ROSS S. WHALEY
Director of News and Publications .... JERI LYNN SMITH
Director of Development .... ARTHUR J. FRITZ, JR.

Provost/Vice President for Academic Affairs .. WILLIAM P. TULLY
Director of Academic Computing .... CHARLES N. LEE
Dean of Instruction and Graduate Studies ... ROBERT H. FREY
Director of Libraries and Learning Resources Center .... DONALD F. WEBSTER
Dean of Nonresident Programs and Continuing Education .... ROBERT C. KOEPPER
Dean of Research .... HELMUTH RESCH
Senior Staff Associate .... J. DONALD MABIE
Director of Institute of Environmental Policy and Planning .... RICHARD C. SMARDON
Director of Analytical and Technical Services .... DAVID A. DRISCOLL
Chair, Chemistry Faculty .... ANATOLE SARKO
Director, Polymer Research Institute .... ISRAEL CABASSO
Director, Cellulose Research Institute .... TORE E. TIMELL
Chair, Environmental and Forest Biology Faculty and Director, Division of Forest Resources .... ROBERT L. BURGESS
Director, Adirondack Ecological Center .... WILLIAM F. PORTER
Chair, Environmental Studies Faculty .... ROBERT D. HENNIGAN
Chair, Forest Engineering Faculty .... ROBERT H. BROCK, JR.
Chair, Forestry Faculty .... BOB G. BLACKMON
Director, Forest Technology Program of the Forestry Faculty .... RICHARD W. MILLER
Chair, Landscape Architecture Faculty .... RICHARD S. HAWKS
Chair, Paper Science and Engineering Faculty .... LELAND R. SCHROEDER
Director, Empire State Paper Research Institute .... LELAND R. SCHROEDER
Chair, Wood Products Engineering Faculty .... LEONARD A. SMITH
Director, N. C. Brown Center for Ultrastructure Studies .... WILFRED A. CÔTÉ, JR.
Director, Tropical Timber Information Center .... ROBERT W. MEYER

Vice President for Administration .... NICK J. PARADISO, JR.
Director of Administrative Computing .... DAVID J. SODERBERG
Director of Business Affairs .... MARK P. FENNESSY
Director of Forest Properties .... RICHARD A. SCHWAB
Director of Institutional Research .... MAUREEN O. FELLOWS
Director of Personnel and Affirmative Action .... MARCIA JAMES
Director of Physical Plant .... JAMES R. VESPI
Director of Public Safety .... KEVIN E. WALSH

Vice President for Student Affairs and Educational Services .... JAMES M. HEFFERNAN
Director of Admissions .... DENNIS O. STRATTON
Director of Alumni Affairs .... JUSTIN F. CULKOWSKI
Director of Career Planning .... THOMAS O. SLOCUM
Director of Financial Aid .... JOHN E. VIEW
College Registrar .... ROBERT S. NORTH
Coordinator of Student Activities and Organizations .... PATRICIA ST. GERMAIN
Project Leader, U.S. Forest Service Cooperative Research Unit .... ROWAN A. ROWNTREE
Co-Directors, Great Lakes Research Consortium .... RICHARD C. SMARDON
ROBERT G. WERNER

COLLEGE FACULTY AND PROFESSIONAL STAFF

DISTINGUISHED SERVICE PROFESSOR

WILFRED A. COTE, JR., *Distinguished Service Professor*, Wood Products Engineering Faculty

DISTINGUISHED TEACHING PROFESSOR

GEORGE W. CURRY, *Distinguished Teaching Professor*, Landscape Architecture Faculty

DANIEL L. DINDAL, *Distinguished Teaching Professor*, Environmental and Forest Biology Faculty

DISTINGUISHED ADJUNCT PROFESSOR

HARRY L. FRISCH, *Distinguished Adjunct Professor*, Chemistry Faculty

DISTINGUISHED TEACHING PROFESSOR EMERITUS

EDWIN H. KETCHLEDGE, *Distinguished Teaching Professor Emeritus*, Environmental and Forest Biology Faculty

THEODORE J. STENUF, *Distinguished Teaching Professor Emeritus*, Paper Science and Engineering Faculty

DISTINGUISHED PROFESSOR EMERITUS

CONRAD SCHUERCH, *Distinguished Professor Emeritus*, Chemistry Faculty

MICHAEL M. SZWARC, *Distinguished Professor Emeritus*, Polymer Research Institute.

FACULTY AND PROFESSIONAL STAFF

This listing represents an official record of the State University of New York College of Environmental Science and Forestry faculty and professional staff for 1990. It is designed for use in 1990-91.

The date in parentheses after each name denotes the first year of service, two or more dates, the term of service.

LAWRENCE P. ABRAHAMSON (1977), *Senior Research Associate*, Forestry Faculty and Environmental and Forest Biology Faculty; B.S., Michigan Technological University, 1964; M.S., University of Wisconsin, 1967; Ph.D., 1969

THOMAS C. ALEXANDER (1987), *Research Support Specialist*, Paper Science and Engineering/Empire State Paper Research Institute; B.S./ACS Certification, SUNY at Brockport, 1986

DOUGLAS C. ALLEN (1968), *Professor*, Environmental and Forest Biology Faculty; B.S., University of Maine, 1962; M.S., 1965; Ph.D., University of Michigan, 1968

WAYNE ALLEN (1979), *Instructional Support Associate*, Forest Technology Program of the Forestry Faculty

DAVID G. ANDERSON (1959), *Professor*, Forestry Faculty; *Executive Assistant to the President; Director, Northeast Petroleum-Forest Resources Cooperative*; A.A.S., State University of New York College of Forestry (Ranger School), 1950; B.S., State University of New York College of Forestry, 1953; M.S., University of Utah, 1958; M.P.A., Syracuse University, 1974

RAYMOND J. APPLEBY (1982), *Instructional Support Technician*, Paper Science and Engineering Faculty; A.S., State University of New York Columbia-Greene, 1980

HENRY T. APPLETON (1989), *Adjunct Professor*, Environmental and Forest Biology; B.S., State University of New York College of Environmental Science and Forestry, 1971; Ph.D., 1976

ROBERT W. ARSENEAU (1972), *Senior Programmer/Analyst*, Administrative Computing; A.A.S., Mohawk Valley Community College, 1967; B.S., Syracuse University, 1978

DONALD E. ARTZ (1987), *Project Staff Assistant*, Office of Research Programs; B.S., SUNY Oswego, 1987

CAROLINE B. BAILEY (1978), *Senior Staff Assistant*, Landscape Architecture Faculty

GUY BALDASSARRE (1987), *Associate Professor*, Environmental and Forest Biology Faculty; B.S., University of Maine, 1975; M.S., University of Wisconsin, Stevens Point; 1978; Ph.D., Texas Tech University, 1982

JAMES P. BAMBACHT (1967), *Professor*, Paper Science and Engineering Faculty; *Executive Secretary*, Syracuse Pulp and Paper Foundation; A.B., Kalamazoo College, 1954; M.S., The Institute of Paper Chemistry, 1956; Ph.D., State University of New York College of Environmental Science and Forestry, 1973

MARCIA A. BARBER (1989), *Personnel Associate*, Personnel and Affirmative Action; B.A., State University of New York at Brockport, 1980

CHARLES J. BARNETT (1988), *Research Support Specialist*, Environmental and Forest Biology; B.S., The University of Michigan, 1986; Master of Forestry, 1988

GEORGE R. BATTLES (1987), *Instructional Support Specialist*, Analytical and Technical Services; A.A.S., SUNY Agricultural and Technical College, Morrisville, 1966; B.E.T., Rochester Institute of Technology, 1973

JON D. BEAM (1988), *Educational Assistant*, Adirondack Wildlife Program, Newcomb Campus; B.A., Shippensburg University, 1975; M.S., West Virginia University, 1983

JOHN D. BENNETT (1960), *Associate Professor*, Forestry Faculty; B.A., Ohio Wesleyan University, 1954; Ph.D., Syracuse University, 1968; *Chancellor's Award for Excellence in Teaching* (1973)

DONALD H. BICKELHAUPT (1969), *Instructional Support Specialist*, Forestry Faculty; B.S., State University of New York College of Forestry, 1970; M.S., State University of New York College of Environmental Science and Forestry, 1980

ARTHUR J. BILCO (1983), *Staff Associate*, Physical Plant

ELIZABETH BISHCHOFF (1989), *Research Support Specialist*, Chemistry Faculty; B.A., Williams College, 1983; M.S., Syracuse University, 1989

PETER E. BLACK (1965), *Professor*, Forestry Faculty; B.S., University of Michigan, 1956; M.F., 1958; Ph.D., Colorado State University, 1961; *Executive Chairman of the Faculty* (1974-78)

BOB G. BLACKMON (1987), *Chair and Professor*, Forestry Faculty; B.S., Louisiana Tech University, 1962; M.F., Duke University, 1963; Ph.D., Louisiana State University, 1969

RAYMOND W. BLASKIEWICZ (1982), *Associate College Registrar*, Registrar's Office; B.S., State University of New York College of Environmental Science and Forestry, 1979; M.S., Syracuse University, 1988

CONSTANCE H. BOBBIE (1982), *Associate Librarian*, F. Franklin Moon Library/Learning Resources Center; B.S., Bemidji State College, 1956; M.A., University of Minnesota, 1962

WILLIAM R. BORGSTEDE (1971), *Instructional Support Technician*, Environmental and Forest Biology Faculty; A.A.S., Miner Institute, 1966; A.A.S., State University of New York College at Delhi, 1970; B.S., State University of New York College of Environmental Science and Forestry, 1975; M.S., Syracuse University; 1978

GREGORY L. BOYER (1985), *Assistant Professor*, Faculties of Chemistry and Environmental Studies; A.S., Reedley College, 1973; A.B., University of California, 1975; Ph.D., University of Wisconsin, 1980

CARL F. BRAENDLE (1976), *Assistant Director*, Campus Public Safety; B.A., Columbia College, 1989

STEPHEN B. BRANDT (1983), *Adjunct Associate Professor*, Environmental and Forest Biology Faculty; B.A., University of Wisconsin, 1972; M.S., 1975; Ph.D., 1978

BRUCE W. BREITMEYER (1983), *Instructional Support Specialist*, Adirondack Forest Properties; B.S.F., University of Michigan, 1975; M.S., 1982

JEROME BREZNER (1961), *Professor*, Environmental and Forest Biology Faculty; A.B., University of Rochester, 1952; A.M., University of Missouri, 1956; Ph.D., 1959; Postdoctoral, Dartmouth Medical School, 1960; *Executive Chairman of the Faculty*, (1974-76); *State University of New York Senator*, (1984-87)

ROBERT H. BROCK, JR. (1967), *Chair and Professor*, Forest Engineering Faculty; *Director of the Division of Engineering*; B.S., State University of New York College of Forestry, 1958; M.S., 1959; Ph.D., Cornell University, 1971

RAINER H. BROCKE (1969), *Associate Professor*, Environmental and Forest Biology Faculty; B.S., Michigan State University, 1955; M.S., 1957; Ph.D., 1970

ALTON F. BROWN (1963), *Research Support Specialist*, Empire State Paper Research Institute

THOMAS E. BROWN (1977), *Adjunct Assistant Professor*, Environmental and Forest Biology Faculty; B.S. Niagara University, 1957; M.S., State University of New York College of Forestry, 1968

PATRICIA BURAK (1983), *Adjunct Associate Foreign Student Counselor*, Office of Student Affairs and Educational Services; B.A., State University of New York College at Oswego, 1973; M.A., State University of New York College at Albany, 1974

ROBERT L. BURGESS (1981), *Chair and Professor*, Environmental and Forest Biology Faculty; *Director*, Division of Forest Resources; B.S., University of Wisconsin, Milwaukee, 1957; M.S., University of Wisconsin, Madison, 1959; Ph.D., 1961

KENNETH F. BURNS (1970), *Instructional Support Technician*, Forestry Faculty; A.A.S., Paul Smith's College, 1969

ISRAEL CABASSO (1981), *Professor*, Chemistry Faculty; *Director*, Polymer Research Institute; B.S., Hebrew University, 1966; M.S., 1968; Ph.D. Weizmann Institute of Science, 1973

PAUL M. CALUWE (1969), *Associate Professor*, Chemistry Faculty; *Associate Member*, Polymer Research Institute; Ph.D., University of Leuven, Belgium, 1967

ROBERT W. CAMPBELL (1984), *Adjunct Professor*, Environmental and Forest Biology Faculty; B.S., New York State College of Forestry, 1953; M.S., University of Michigan, 1959; Ph.D., 1961

HUGH O. CANHAM (1966), *Professor*, Forestry Faculty; B.S., State University of New York College of Forestry, 1960; M.S., 1962; Ph.D., 1971

EMANUEL J. CARTER, JR. (1985), *Assistant Professor*, Landscape Architecture Faculty; B.A., Cornell University, 1969; Master of Regional Planning, 1978

COSTAS A. CASSIOS (1978), *Adjunct Professor*, Landscape Architecture Faculty; B.S., University of Thessaloniki, 1965; M.S., Graduate Industrial School, 1969; M.S., University of Wisconsin, 1972; Ph.D., 1976

JOHN D. CASTELLO (1978), *Associate Professor*, Environmental and Forest Biology Faculty; B.A., Montclair State College, 1973; M.S., Washington State University, 1976; Ph.D., University of Wisconsin, 1978

ROBERT E. CHAMBERS (1967), *Professor*, Environmental and Forest Biology Faculty; B.S., Pennsylvania State University, 1954; M.S., 1956; Ph.D., Ohio State University, 1972

DIANE CHEPKO-SADE (1989), *Adjunct Professor*, Environmental and Forest Biology Faculty; B.A., Duke University, 1971; M.A., University of Puerto Rico, 1977; Ph.D., Northwestern University, 1982; M.S., 1987

GARY E. COLELLA (1986), *Facilities Program Coordinator*, Physical Plant; A.A.S., Auburn Community College, 1963

SHIRLEY CONNAL (1981), *Personnel Associate*, Personnel and Affirmative Action

WILFRED A. CÔTÉ, JR. (1950), *Distinguished Service Professor, Wood Technology*, Wood Products Engineering Faculty; *Director*, N.C. Brown Center for Ultrastructure Studies; B.S., University of Maine, 1949; M.F., Duke University, 1950; Ph.D., State University of New York College of Forestry, 1958; *Executive Chairman of the Faculty* (1970-72)

JAMES E. COUFAL (1961), *Professor/Undergraduate Education Coordinator*, Forestry Faculty; Certificate, State University of New York College of Forestry (Ranger School), 1957; B.S., State University of New York College of Forestry, 1960; M.S., 1962; Ed.S., State University of New York at Albany, 1976

PHILLIP J. CRAUL (1968), *Professor*, Forestry Faculty; B.S.F., Pennsylvania State University, 1954; M.S., 1960; Ph.D., 1964

JAMES O. CREVELLING (1970), *Forest Property Manager*, Experiment Station and Heiberg Forest, Wanakena and Cranberry Campuses; A.A.S., Paul Smith's College, 1965; B.S., University of Massachusetts, 1967

CLAY M. CROSBY (1964), *Research Scientist*, Empire State Paper Research Institute; B.S., State University of New York College of Forestry, 1964; M.S., 1970

JUSTIN F. CULKOWSKI (1978), *Director of Alumni Affairs*, B.S., State University of New York College of Environmental Science and Forestry, 1973; M.B.A., Syracuse University, 1983

TIBERIUS CUNIA (1968), *Professor*, Forestry Faculty; Forest Engineer, Ecole Nat. des Eaux et Forets, Nancy-France, 1951; M.S., McGill University, Montreal, Canada, 1957

GEORGE W. CURRY (1966), *Distinguished Teaching Professor*, Landscape Architecture Faculty; B.A., Michigan State University, 1962; B.S., 1965; M.L.A., University of Illinois, 1969

BENJAMIN V. DALL (1975), *Professor*, Faculties of Environmental Studies and Forestry; B.S., Yale University, 1955; M.F., 1956; J.D., University of Virginia, 1959; Ph.D., Pennsylvania State University, 1972

ROBERT W. DAVIDSON (1957), *Professor*, Wood Products Engineering Faculty; B.S., Montana State University, 1948; M.S., State University of New York College of Forestry, 1956; Ph.D., 1960

CRAIG J. DAVIS (1987), *Assistant Professor*, Forestry Faculty; A.A.S., Williamsport Area Community College, 1978; B.S.F.E., University of Maine, 1982; M.S.F., Purdue University, 1984; Ph.D., 1987

CHAD DAWSON (1986), *Assistant Professor*, Forestry Faculty; B.S., University of Michigan, 1970; M.P.S., Cornell University, 1979; Ph.D., State University of New York College of Environmental Science and Forestry, 1983

ARNOLD C. DAY (1947), *Instructional Support Specialist*, N.C. Brown Center for Ultrastructure Studies

MICHELE S. DEISCH (1986), *Instructional Support Associate*, Newcomb Campus; B.S., South Dakota State University, 1983; M.S., 1986

SALVACION DE LA PAZ (1973), *Associate Librarian*, F. Franklin Moon Library/Learning Resources Center; B.S.L.S., University of the Philippines, 1956; M.S.L.S., Simmons College, 1962

CARLTON W. DENCE (1951), *Professor*, Empire State Paper Research Institute; B.S., Syracuse University, 1947; M.S., State University of New York College of Forestry, 1949; Ph.D., 1959

DANIEL L. DINDAL (1966), *Distinguished Teaching Professor*, Environmental and Forest Biology Faculty; B.S. Ed. and B.S. Agri., Ohio State University, 1958; M.A., 1961; Ph.D., 1967; *Chancellor's Award for Excellence in Teaching* (1974)

MARTA L. DOSA (1987), *Adjunct Professor*, Environmental Studies Faculty; B.A., University of Budapest Comparative Literature, 1943; M.A., 1944; M.S.L.S., Syracuse University Library Science, 1957; Ph.D., University of Michigan Library Science, 1971

ALLAN P. DREW (1980), *Associate Professor*, Forestry Faculty; B.S., University of Illinois, 1965; M.S., University of Arizona, 1967; Ph.D., Oregon State University, 1974

DAVID A. DRISCOLL (1986), *Director*, Analytical and Technical Services; A.A.S., State University of New York Agricultural and Technical College at Farmingdale, 1964; B.S., M.S., Fairleigh Dickinson University, 1974; Ph.D., Fordham University, 1978

MARK DRISCOLL (1986), *Instructional Support Specialist*, Research Programs; A.A., State University of New York Agricultural and Technical College at Delhi, 1979; B.S., St. John's University, 1982

MICHAEL J. DUGGIN (1979), *Professor*, Forest Engineering Faculty; B.Sc., Melbourne University, Australia, 1959; Ph.D., Monash University, Australia, 1965; F. Inst. P. (London), C. Phys. (London), F.O.S.A.

ANDREW L. EGGERS (1967), *Assistant for Instructional Resources*, Instructional Services

ELIZABETH A. ELKINS (1973), *Associate Librarian*, F. Franklin Moon Library/Learning Resources Center; B.A., Hartwick College, 1968; M.L.S., State University of New York at Geneseo, 1970; *Chancellor's Award for Excellence in Librarianship* (1980); *Executive Chair of Faculty* (1986-88)

KATHRYNN ERIKSSON (1987), *Research Support Specialist*, Empire State Research Institute; B.S., St. John Fisher College, 1987

ARTHUR R. ESCHNER (1964), *Professor*, Faculties of Forestry and Environmental Studies; B.S., State University of New York College of Forestry, 1950; M.S., Iowa State College, 1952; Ph.D., State University of New York College of Forestry, 1965

AMINUR EUSUFZAI (1973), *Research Scientist*, Empire State Paper Research Institute; B.Sc. (Hons.), Dacca University, 1957; M.Sc., 1960; B.Sc. (Hons.) Forestry, Peshawar University, 1962; M.S., West Virginia University, 1969; M.S., State University of New York College of Environmental Science and Forestry, 1982

F. W. GORDON FEARON (1986), *Adjunct Professor*, Chemistry Faculty; G.S., University of Leeds, 1961; Ph.D., University of Wales, 1965; P.M.D., Harvard Business School, 1975

JOHN P. FELLEMAN (1973), *Professor and Director of Graduate Program*, Environmental Studies Faculty; B.C.E., Cornell University, 1966; M.E.C., 1966; N.D.E.A. Fellow, University of North Carolina, 1967; D.P.A., New York University, 1973; New York State Professional Engineer

MAUREEN O'NEILL FELLOWS (1986), *Director*, Institutional Research; A.B., Hamilton College, 1980; M.S., Cornell University, 1985

MARK P. FENNESSY (1989), *Director*, Business Affairs; B.A., State University of New York at Buffalo, 1968; M.B.A., State University of New York at Buffalo, 1983

DAVID L. FINCH (1985), *Instructional Support Specialist*, Analytical and Technical Services; A.A.S., Florida Keys Community College, 1980; A.A.S., Onondaga Community College, 1985; B.S.E.S., State University of New York College of Environmental Science and Forestry, 1988

JOHN S. FISHLOCK (1965), *Instructional Support Technician*, Environmental and Forest Biology Faculty; A.A.S., State University of New York College of Forestry, 1975

RAYMOND C. FRANCIS (1987), *Research Associate*, Paper Science and Engineering Faculty; B.A.Sc., University of Toronto, 1982; Ph.D., 1987

CLAUDE C. FREEMAN (1959), *Associate Professor*, Landscape Architecture Faculty; B.S. in Landscape Architecture, State University of New York College of Forestry, 1959

ROBERT H. FREY (1977), *Dean of Instruction and Graduate Studies/Associate Professor;* B.A., Valparaiso University, 1965; M.Ed., Springfield College, 1966; Ed.D., Indiana University, 1973

HARRY L. FRISCH (1980), *Adjunct Professor*, Chemistry Faculty; *Associate Member*, Polymer Research Institute; A.B., Williams College, 1947; Ph.D., Polytechnic Institute of Brooklyn, 1952

ARTHUR J. FRITZ, JR. (1985), *Director of Development*, A.B., Syracuse University, 1962

DOUGLAS H. FROST (1982), *Assistant Director*, Business Affairs; A.A., College of San Mateo, 1962; B.S., Wagner College, 1967

WEN ZHI GAI (1989), *Research Support Specialist*, Chemistry Faculty; B.S., Beijing University, 1968; M.S., 1981

LINDA M. GALLOWAY (1990), *Instructional Support Specialist*, Environmental and Forest Biology Faculty; B.S., Long Island University, 1980

RONALD J. GIEGERICH (1977), *Instructional Support Specialist*, Environmental and Forest Biology Faculty; A.A.S., State University of New York Agricultural and Technical College at Cobleskill, 1975; B.S., State University of New York College of Environmental Science and Forestry, 1978

KENNETH A. GIFFORD (1989), *Adjunct Assistant Professor*, Landscape Architecture Faculty; B.L.A. and B.E.S., State University of New York College of Environmental Science and Forestry, 1971

MICHAEL GOODEN (1982), *Instructional Support Associate*, Newcomb Campus; A.A.S., State University of New York Agricultural and Technical College at Morrisville, 1976; B.S., State University of New York College of Environmental Science and Forestry, 1978

W. DOUGLAS GOULD (1983), *Adjunct Assistant Professor*, Environmental and Forest Biology Faculty; B.S., University of Manitoba, 1965; M.S., University of Alberta, 1970; Ph.D., 1976

DANIEL GRAIVER (1989), *Adjunct Professor*, Chemistry Faculty; B.S., Hebrew University of Jerusalum, 1971; M.S., 1973; Ph.D., Case Western Reserve University, 1977

STEPHEN GRANZOW (1969), *Instructional Support Associate*, Empire State Paper Research Institute

MIKLOS A. J. GRATZER (1973), *Professor*, Faculties of Forestry and Environmental Studies; Forest Engineer, Sopron University; B.Sc., University of British Columbia, 1959; M.S. (R.C.), University of Montana, 1965; Ph.D., 1971

BENITA GREEN (1989), *Research Support Specialist*, Chemistry Faculty; B.S., Hartwick College, 1989

CHARLES GREEN, JR. (1979), *Adjunct Professor*, Paper Science and Engineering Faculty; B.S., University of Iowa, 1956

DAVID H. GRIFFIN (1968), *Professor*, Environmental and Forest Biology Faculty; B.S., State University of New York College of Forestry, 1959; M.A., University of California, 1960; Ph.D., 1963

KEVIN J. GUERIN (1988), *Instructional Support Specialist*, Analytical and Technical Services; A.A.S., Onondaga Community College, 1987

CHARLES A. S. HALL (1987), *Associate Professor*, Environmental and Forest Biology Faculty; B.A., Colgate University, 1965; M.S., Pennsylvania State University, University Park, 1966; Ph.D., University of North Carolina Chapel Hill, 1970

JAMES P. HALLIGAN (1979), *Instructional Support Specialist*, Forestry Faculty; B.S., State University of New York College of Environmental Science and Forestry, 1974

JUDITH C. HAMILTON (1979), *Financial Aid Advisor*, Financial Aid Office; B.S., State University of New York College at Brockport, 1967; M.S., State University of New York at Albany, 1968

KENNETH E. HAMMEL (1986), *Assistant Professor*, Chemistry Faculty; A.B., University of California, Berkeley, 1974; Ph.D., University of California, Berkeley, 1982.

TERRENCE M. HAMMILL (1986), *Adjunct Professor*, Environmental and Forest Biology Faculty; B.S., State University of New York College at Potsdam, 1963; M.Ed., University of Georgia, 1968; Ph.D., State University of New York College of Environmental Science and Forestry, 1971

ROBERT B. HANNA (1977), *Assistant Director*, N.C. Brown Center for Ultrastructure Studies; *Professor*, Wood Products Engineering Faculty; B.S., University of Michigan, 1967; M.S., State University of New York College of Forestry, 1971; Ph.D., State University of New York College of Environmental Science and Forestry, 1973

DAVID L. HANSELMAN (1963), *Professor*, Faculties of Landscape Architecture and Environmental Studies; B.S., Cornell University, 1957; M.S., 1958; Ph.D., The Ohio State University, 1963

JAMES M. HASSETT (1981), *Associate Professor*, Forest Engineering Faculty; A.B., Cornell University, 1970; M.S., Syracuse University, 1979; Ph.D., 1988

JOHN P. HASSETT (1980), *Associate Professor*, Chemistry Faculty; B.S., University of Maryland, 1971; M.S., University of Wisconsin, 1973; Ph.D., 1978

RICHARD S. HAWKS (1979), *Chair and Associate Professor*, Landscape Architecture Faculty; B.L.A., State University of New York College of Environmental Science and Forestry, 1972; M.L.A., Harvard University, 1978

JAMES M. HEFFERNAN (1985), *Vice President for Student Affairs and Educational Services;* A.B., Lafayette College, 1965; M.A., Columbia University Teachers College, 1967; M.A., University of Michigan, 1970; Ph.D., 1971

GORDON M. HEISLER (1973), *Adjunct Associate Professor*, Forestry Faculty; B.S., Pennsylvania State University, 1961; M.F., Yale University, 1962; Ph.D., State University of New York College of Forestry, 1970

TORBJORN HELLE (1989), *Research Support Specialist*, Paper Science and Engineering Faculty; M.S.C., The Norwegian Institue of Technology, 1958; Ph.D., 1963

ROBERT D. HENNIGAN (1967), *Chair and Professor*, Environmental Studies Faculty; B.C.E., Manhattan College, 1949; M.A., Syracuse University, 1964, P.E., New York State

LEE P. HERRINGTON (1965), *Professor*, Forestry Faculty; B.S., University of Maine, 1959; M.F., Yale School of Forestry, 1960; Ph.D., Yale University, 1964

ROBERT A. HOLM (1982), *Associate Professor*, Paper Science and Engineering Faculty; B.S., University of Illinois, 1958; M.S., University of Delaware, 1961; Ph.D., 1962

WILLIAM HOLTZMAN (1987), *Assistant Professor*, Paper Science and Engineering Faculty; B.S.Ch.E., Pennsylvania State University, 1953; M.S., Lawrence University (The Institute of Paper Chemistry), 1955; Ph.D., 1959

MARY O'BRIEN HOOVEN (1980), *Staff Associate*, Wanakena and Cranberry Lake Campuses, B.A., State University of New York at Buffalo, 1972

PAUL F. HOPKINS (1979), *Assistant Professor*, Forest Engineering Faculty; B.S., University of Maine, 1977; M.S., State University of New York College of Environmental Science and Forestry, 1979

ALLEN F. HORN, JR. (1957), *Professor*, Forestry Faculty; B.S., Michigan State University, 1950; M.S., 1951; Ph.D., State University of New York College of Forestry, 1957; LL.B., Syracuse University, 1967

STEVEN B. HORSLEY (1977), *Adjunct Associate Professor*, Forestry Faculty; B.S., Pennsylvania State University, 1965; M.A., University of Massachusetts, 1968; Ph.D., University of Massachusetts, 1970

JOEL R. HOWARD (1974), *Assistant Professor*, Forestry Faculty;B.S., *Director*, Summer Program in Field Forestry; New York State Ranger School, 1966; B.S., State University of New York College of Environmental Science and Forestry, 1973; M.S., 1978; Ph.D., North Carolina State University, 1986

JOHN J. HOWARD (1978), *Adjunct Associate Professor*, Environmental and Forest Biology Faculty; B.A., University of New Hampshire, 1966; M.P.H., Yale University, 1970, Dr. P.H., 1973

RAFAAT M. HUSSEIN (1987), *Associate Professor*, Wood Products Engineering Faculty; B.Sc., El-Azhar University, 1974; M.Eng., Concordia University, 1978; Ph.D., 1980; P.E., 1980

MARCIA JAMES (1985), *Director*, Personnel and Affirmative Action; B.A., Grove City College, 1960; M.A., Cornell University, 1962; M.A., 1965; J.D., Syracuse University, 1978

ROBERT V. JELINEK (1972), *Professor*, Paper Science and Engineering Faculty; B.S., Columbia University, 1945; M.S., 1947; Ph.D., 1953

DAVID L. JOHNSON (1975), *Associate Professor*, Chemistry Faculty; B.S., Antioch College, 1965; Ph.D., University of Rhode Island, 1973

WILLIAM L. JOHNSON (1987), *Instructional Support Specialist*, Forest Engineering Faculty; B.S., University of Wisconsin, 1972; M.S., 1974

DIANNE M. JUCHIMEK (1967), *Associate Librarian*, F. Franklin Moon Library/Learning Resources Center; B.S., University of Illinois, 1965; M.S.L.S., Syracuse University, 1967

RONALD R. KARNS (1965), *Associate Director of Community Relations*, News and Publications; B.S., Ohio State University, 1954

ROWENA V. KATHER (1974), *Inventory Control Manager*, Analytical and Technical Services; B.A., Syracuse University, 1979; M.P.A., 1981

WILLIAM L. KELLEHER, JR. (1988), *Instructional Support Technician*, Wood Products Engineering Faculty; B.S., State University of New York College of Environmental Science and Forestry, 1985

JOSEPH F. KEULER (1988), *Assistant Professor*, Wood Products Engineering Faculty; B.S., Pratt Institute, 1973; M.S., Rochester Institute of Technology, 1976; M.C.E., Manhattan College, 1978

DAVID J. KIEMLE (1986), *Instructional Support Specialist*, Analytical and Technical Services, Office of Research Programs; B.S., State University of New York College at Oswego, 1983

JUDITH J. KIMBERLIN (1981), *Assistant Director*, Personnel and Affirmative Action; A.A.S., Pennsylvania State University, 1964; B.A., State University of New York College at Cortland, 1975

ROBERT C. KOEPPER (1986), *Dean of Nonresident Programs*; Continuing Education; B.A., Concordia Teachers College, 1958; M.A., 1962; Ed.D., George Peabody College for Teachers, 1966

RICHARD F. KOPP (1988), *Senior Research Support Specialist*, Forestry Faculty; B.S., State University of New York College of Environmental Science and Forestry, 1984; M.S., The Pennsylvania State University, 1986

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RHONDDA K. CASSETTA (1973-1981), *Associate for Institutional Research Emeritus;* A.B., Elmira College, 1933

DANIEL M. CASTAGNOZZI (1956-1977), *Professor and Director Emeritus;* A.A.S., State University of New York College of Forestry (Ranger School), 1950; B.S.F., University of Michigan, 1952; M.F., State University of New York College of Forestry, 1957

RUSSELL C. DECKERT (1952-1976), *Professor Emeritus;* B.S.F., University of Georgia, 1938; M.F., Duke University, 1943

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GEORGE F. EARLE (1952-1983), *Professor Emeritus;* B.F.A., Syracuse University, 1937; M.F.A., Yale University, 1946

JOHN H. ENGELKEN (1952-1982), *Forest Property Manager Emeritus;* B.S.F., Utah State University, 1950

JEAN E. FISHER (1950-52) (1963-1981), *Senior Research Associate Emeritus;* B.S., University of Idaho, 1941

ROBERT L. FRIEDMAN (1967-1985), *Director of Admissions Emeritus;* A.B., Syracuse University, 1952; M.A., 1954

RUSSELL E. GETTY (1966-1973), *Professor Emeritus;* B.S., Iowa State College, 1936; M.S., 1951

SERGE N. GORBATSEVICH (1956-1986), *Associate Professor Emeritus;* B.S., State University of New York College of Forestry, 1954; M.S., 1955

PAUL F. GRAVES (1947-1988), *Professor Emeritus*; B.S., New York State College of Forestry, 1939; M.S., 1941; Ph.D., Syracuse, University, 1949

DONALD F. GREEN (1965-1978), *Registrar Emeritus;* A.B., New York State College for Teachers, Albany, 1942; M.S., 1950

GEORGE H. HAINES (1953-1968), *Director of Business Affairs Emeritus;* B.S., University of Rhode Island, 1932

ROY C. HARTENSTEIN (1959-65) (1967), *Professor*, Faculties of Environmental and Forest Biology and Environmental Studies; B.S., State Teachers College at Buffalo, 1953; M.S., Syracuse University, 1957; Ph.D., State University of New York College of Forestry, 1959

RAY R. HIRT (1921-1959), *Senior Professor Emeritus;* B.S., Hamline University, 1917; M.S., New York State College of Forestry, 1924; Ph.D., 1928

EDWIN C. JAHN (1938-1972), *Dean Emeritus; Professor Emeritus;* B.S., New York State College of Forestry, 1925; M.S., 1926; Ph.D., McGill University, 1929

HAZEL S. JENNISON (1965-1984), *Research Associate Emeritus;* B.S., Western Kentucky State University, 1941; M.S., Syracuse University, 1966

EDWIN H. KETCHLEDGE (1955-1985), *Distinguished Teaching Professor Emeritus;* B.S., State University of New York College of Forestry, 1949; M.S., 1950; Ph.D., Stanford University, 1957

THEODORE J. KOCHANEK (1971-1976), *Director of Physical Plant Emeritus*

RONALD F. LAPLAINE (1948-1983), *Technical Specialist Emeritus*, Department of Paper Science and Engineering

CHARLES C. LARSON (1950-1983), *Professor Emeritus;* A.S., North Dakota State School of Forestry, 1938; B.S., University of Minnesota, 1940; M.S., University of Vermont, 1943; Ph.D., State University of New York College of Forestry, 1952

ORRIN L. LATHAM (1930-1966), *Associate Professor Emeritus;* B.S.F., Iowa State College, 1927; Yale University, 1932

RICHARD V. LEA (1967-1985), *Professor Emeritus;* B.S., State University of New York College of Forestry, 1946; M.S., 1948; Ph.D., 1953

BENGT LEOPOLD (1961-1985), *Professor Emeritus;* B.Sc., Royal Institute of Technology, Stockholm, 1947; Licentiat, 1949; Ph.D., 1952

JOSIAH L. LOWE (1933-1975), *Professor Emeritus;* B.S., New York State College of Forestry, 1927; Ph.D., University of Michigan, 1938

AUBREY H. MACANDREWS (1926-1962), *Professor Emeritus;* Truro Agriculture College, 1922; B.S., New York State College of Forestry, 1925; M.S., 1926

RAYMOND L. MARLER (1970-1981), *Senior Research Associate Emeritus;* B.S., University of Michigan, 1948; M.F., 1948

CHARLES E. MARTIN II (1962), *Professor*, Forest Technology Program of the Forestry Faculty; B.S., Duke University, 1953; M.F., 1954

RENATA MARTON (1957), *Senior Research Associate Emeritus;* Master Ph. (Chemistry), Jagiello University, 1934; Ph.D., 1936

JOHN A. MEYER (1958-1985), *Associate Director Emeritus, Senior Research Associate* and *Professor Emeritus;* B.S., Pennsylvania State College, 1949; M.S., 1950; Ph.D., State University of New York College of Forestry, 1958; *Chancellor's Award for Excellence in Professional Service*, 1977

HOWARD C. MILLER (1950-1982), *Professor and Extension Specialist Emeritus;* B.S., New York State College of Forestry, 1941; Ph.D., Cornell University, 1951

RAYMOND A. MOORE (1954-1985), *Associate Professor Emeritus;* B.S.F., West Virginia University, 1951; M.S., North Carolina State College, 1952

JOHN L. MORRISON (1946-1971), *Professor Emeritus;* A.B., University of Nebraska, 1933; A.M., 1935; Ph.D., University of California, 1941

HARRISON H. PAYNE (1964-1987), *Vice President for Student Affairs and Professor Emeritus;* B.S., State University of New York College of Forestry, 1950; M.Ed., St. Lawrence University, 1955; Ed.D., Cornell University, 1963

RICHARD E. PENTONEY (1953-1979), *Vice President for Program Affairs Emeritus;* B.S., University of California, 1949; M.S., State University of New York College of Forestry, 1952; Ph.D., 1956

ROBERT B. RAYMISH (1956-1983), *Assistant Director of Physical Plant Emeritus*, Office of the Vice President for Administration and Services

SAMUEL ROTHENBERG (1946-1986), *Senior Research Associate Emeritus*; B.S., State University of New York College of Forestry, 1943; M.S., 1964

CONRAD SCHUERCH (1949-1983), *Distinguished Professor Emeritus*; B.S., Massachusetts Institute of Technology, 1940; Ph.D., 1947

BRADFORD G. SEARS (1941-1976), *Dean Emeritus; Professor Emeritus*; B.S., New York State College of Forestry, 1939; M.S., State University of New York College of Forestry, 1948

HARDY L. SHIRLEY (1945-1967), *Dean Emeritus; Professor Emeritus*; B.A., Indiana University, 1922; Ph.D., Yale University, 1928; D.h.c., University of Helsinki, 1958; D.Sc., Syracuse University, 1966

JOHN F. SIAU (1963-1964) (1965)· (1966-1985), *Professor Emeritus*; B.S., Michigan State College, 1943; M.S., State University of New York College of Forestry, 1965; Ph.D., 1968

SAVEL B. SILVERBORG (1947-1977), *Professor Emeritus*; B.S., University of Idaho, 1936; Ph.D., University of Minnesota, 1948

ROBERT M. SILVERSTEIN (1969-1986), *Professor Emeritus*; B.S., University of Pennsylvania, 1937; M.S., New York University, 1941; Ph.D., 1949

JOHN B. SIMEONE (1948-1983), *Professor Emeritus*; B.S., Rhode Island State College, 1942; M.F., Yale University, 1948; Ph.D., Cornell University, 1960

CHRISTEN SKAAR (1946-1948) (1949-1976), *Professor Emeritus*; B.S., New York State College of Forestry, 1943; M.S., State University of New York College of Forestry, 1948; Ph.D., Yale University, 1957

LEROY C. STEGEMAN (1929-1965), *Professor Emeritus*; B.S., Michigan State College, 1928; M.S., University of Michigan, 1929

THEODORE J. STENUF (1960-1988), *Distinguished Teaching Professor Emeritus*; B.Ch.E., Syracuse University, 1949; M.Ch.E., 1951; Ph.D., 1953

WESLEY E. SUHR (1974-1988), *Associate Professor Emeritus*; B.S., University of Minnesota, 1958; M.S., University of Arizona, 1965

VIVIAN R. SUTTON (1962-1976), *Associate Professor Emeritus*; B.A., Oberlin College, 1934; M.A., Bryn Mawr College, 1937; Ph.D., 1942

MICHAEL M. SZWARC (1952-1979), *Distinguished Professor Emeritus*; Ch.E., Warsaw Polytechnic College, 1932; Ph.D., Hebrew University, 1945; Ph.D., Manchester University, 1947; D.Sc., 1949

WILLIAM C. TIERSON (1949-1983), *Director of Wildlife Research Emeritus*; B.S., State University of New York College of Forestry, 1949; M.F., 1967

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ARTHUR T. VIERTEL (1946-1975), *Associate Professor Emeritus*; B.S., New York State College of Forestry, 1942; Ph.D., State University of New York College of Forestry, 1954

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WALTER L. WELCH (1950-1965), *Associate Professor Emeritus*; A.B., Syracuse University, 1946

SIDNEY A. WHITT (1968-1976), *Professor Emeritus*; B.S., University of Alabama, 1933; M.S., Massachusetts Institute of Technology, 1937; D. Engr. Sc., New York University, 1962

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JOHN M. YAVORSKY (1948-56) (1967-1984), *Professor* and *Dean of Continuing Education Emeritus*; B.S., New York State College of Forestry, 1942; M.S., 1947; Ph.D., State University of New York College of Forestry, 1955

ROBERT A. ZABEL (1947-1985), *Professor Emeritus*; B.S., University of Minnesota, 1938; M.S., New York State College of Forestry, 1941; Ph.D., State University of New York College of Forestry, 1948

Index

STATE UNIVERSITY OF NEW YORK
COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY
1 FORESTRY DRIVE
SYRACUSE, NEW YORK 13210-2778

1991 - 92 Catalog

State University of New York College of

Environmental Science and Forestry

Correspondence Directory

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State University of New York

College of Environmental Science and Forestry
1991-92 General Catalog

Academic Calendar

SYRACUSE CAMPUS

FALL 1991

New Student Orientation Program	Aug. 23-26	Friday-Monday
Academic Advising	Aug. 26	Monday
Registration for New Students	Aug. 26	Monday
Classes Begin	Aug. 27	Tuesday
Labor Day (No classes)	Sept. 2	Monday
Fall Break	Oct. 12-14	Saturday-Monday
Thanksgiving Recess	Nov. 27-Dec. 1	Wednesday-Sunday
Registration for Spring 1992	Nov. 20-Dec. 6	Wednesday-Friday
Last Day of Classes	Dec. 10	Tuesday
Reading Day	Dec. 11	Wednesday
Exam Period	Dec. 12-18	Thursday-Wednesday

SPRING 1992

Orientation and Advising for New Students	Jan.13	Monday
Registration for New Students	Jan. 13	Monday
Classes Begin	Jan. 14	Tuesday
Martin Luther King Day (No classes)	Jan. 20	Monday
Spring Recess	Mar. 7-15	Saturday-Sunday
Registration for Fall 1992	Apr. 6-14	Monday-Tuesday
Last Day of Classes	Apr. 29	Wednesday
Reading Day	Apr. 30	Thursday
Exam Period	May 1-7	Friday-Thursday
Commencement	May 10	Sunday

WANAKENA CAMPUS

FALL 1991

Campus Opens	Aug. 19	Monday
Classes Begin	Aug. 19	Monday
Thanksgiving Recess	Nov. 27 - Dec. 1	Wednesday-Sunday
Semester Ends	Dec. 20	Friday

SPRING 1992

Classes Begin	Jan. 13	Monday
M. L. King Day (no classes)	Jan. 20	Monday
Spring Break	Mar. 28 - Apr. 5	Saturday-Sunday
Graduation	May 23	Saturday

ESF: A Vibrant Place

The State University of New York College of Environmental Science and Forestry (ESF) offers students a world that can parallel their fields of study by spanning the globe or remaining as focused as a microscope. An enrollment of 1,800 students and the 12-acre main campus in Syracuse are dwarfed by ESF's international reputation and its 25,000 acres at campuses and field stations throughout the state.

The College provides students and faculty with all the advantages of the SUNY system and adjacent Syracuse University, as well as one of the most intimate atmospheres of any doctoral granting institution. Students can enjoy their own quiet campus and green quad, while exchanging ideas about the natural world with faculty and classmates focused on the same critical issues. Students at ESF also mix with Syracuse University students in classrooms on both campuses, and at the schools' top-notch facilities. In a very real sense, ESF students have the best of both worlds — the intimacy and intellectual atmosphere of a small dynamic college with annual research awards totaling more than $12 million, and the exciting atmosphere of a major private university.

As the 21st century looms and society becomes increasingly concerned about the environment, members of the ESF family also have timing in their favor. The future of the world may be determined by those who have broad foresight and a balance of judgment in applying scientific, technical, and sociological knowledge to guide environmental and human forces. Modern civilization with its compelling demands from industry and government needs people who think objectively and constructively, and act creatively and responsibly. From its start in 1911, the College has served the state, nation, and world in meeting the needs of its citizens through education, research, and public service. Faculty and students at ESF are committed to resolving immediate environmental hazards, learning how to avoid future problems, and offering policy alternatives that will both protect the environment and meet the needs of a global society.

At the undergraduate level, ESF offers curricula in the areas of resource management, engineering, environmental design, and the physical and life sciences. The College prepares graduates to enter the professional world or further pursue their education in graduate school.

The College supports graduate degree programs in six major program areas: environmental and forest biology, forest chemistry, forest resources management, environmental and resource engineering, landscape architecture, and environmental science. Graduate students work purposefully toward a specific goal, while sharpening their ability to think critically and analytically, conduct research, and use basic research tools as well as specialized equipment.

Both the undergraduate and graduate programs, which attracted 146 international students from 41 different countries in the fall of 1990, reflect the efforts of the College's faculty and students to work together to maintain a tradition of academic and professional excellence.

This Catalog provides an introduction to the College, and its programs of undergraduate and graduate study, research, and public service. It only begins to suggest the breadth and diversity of the faculty, students, and programs that prepare ESF graduates for the environmental challenges of the 1990s and beyond.

What's In A Name?

Establishing a Tradition

As the State University of New York College of Environmental Science and Forestry has evolved over its 80-year history, so has its name.

The College was founded in 1911 through the efforts of Syracuse University Chancellor James R. Day and community leaders who were attuned to a growing national sentiment in favor of forest conservation, and sensed the need for a professional school of forestry.

The legislative act which created the New York State College of Forestry at Syracuse University referred to it as the state's "institution for educational work in forestry." The act also instructed faculty to "conduct such special research in statewide investigations in forestry as will throw light upon and help in the solution of forestry problems."

Chancellor Day's early support led to a long history of cooperation between the College and Syracuse University. This relationship remains among the nation's most outstanding examples of collaboration between public and private institutions of higher education. Since its opening, the College has purchased major portions of its supportive curriculum from Syracuse University, which has enabled ESF to more fully develop its undergraduate and graduate level programs.

Since its beginning under Dean Hugh P. Baker, the College has responded to the broad needs of environmental professionalism. As other forestry schools became more specialized, ESF broadened its scope to include such essentials of environmental science as design, engineering, life sciences, and resource management.

In 1948, the State University of New York was formed to coordinate public higher education throughout the state, and the College's name became the State University College of Forestry at Syracuse University. The College, which has always been state-supported and is governed by a Board of Trustees comprised of nine members appointed by the governor and six *ex officio* members, was also recognized as a specialized college within the state system.

The name evolved further in 1972 when it was rechartered as the State University of New York College of Environmental Science and Forestry to reflect more deeply the traditional grounding forestry has in the environment, and to illuminate the breadth of ESF's programs.

For 80 years, the full thrust of the College of Environmental Science and Forestry has been focused on the environment, on all of its six campuses, and in each of its missions: instruction, research, and public service.

The College is a doctoral granting institution with highly focused academic and professional programs that continues to be devoted to the advancement of environmental science and forestry, but places instruction at the top of its list of priorities.

Significant Events

1911 — Governor John A. Dix enacts legislation establishing the New York State College of Forestry at Syracuse University.

1948 — Legislative action incorporates all state-supported higher education into the State University of New York, and the College's name becomes the State University College of Forestry at Syracuse University.

1972 — By special legislative act, the College is rechartered as the State University of New York College of Environmental Science and Forestry.

The Mission: Instruction, Research, and Public Service

The mission of the State University of New York College of Environmental Science and Forestry is to be a world leader in instruction, research, and public service related to:

- Understanding the structure and function of the world's ecosystems;
- Developing, managing, and use of renewable natural resources;
- Improving outdoor environments ranging from wilderness to managed forests to urban landscapes;
- Maintaining and enhancing biological diversity, environmental quality, and resource options.

Instruction

Undergraduate Education

Associate in Applied Science Degree

Since 1912, the College has been training forest technicians on its 2,800-acre Wanakena Campus in the Adirondack Mountains. It is the oldest ranger school in the United States, and offers a two-year forest technology curriculum that provides graduates with an associate in applied science degree.

The curriculum requires students to take their first year of general education at a two- or four-year college. The second year, which emphasizes practical field training in the relationships between forest technology and managerial needs, is taken at Wanakena.

Graduates of this degree program in practical forestry are prepared for the following positions: forest ranger; federal, state or private industry forest technician or forestry aide; district forest supervisor; timber inventory specialist; timber sales supervisor; forest surveyor or engineering aide; or forest protection technician.

Bachelor's Degree

At the baccalaureate level, the College offers professional study in eight areas: chemistry, environmental and forest biology, environmental studies, forest engineering, landscape architecture, paper science and engineering, resource management, and wood products engineering. In addition, the College offers a dual program that combines both environmental and forest biology and resource management. These programs are registered with the New York State Education Department.

These curricula generally lead to a bachelor of science degree. In the case of landscape architecture, which is a five-year program, a bachelor of landscape architecture degree is awarded. In the forest engineering program, a fifth year leading to a bachelor's degree in civil engineering can be taken at Syracuse University or the State University of New York at Buffalo.

Graduate Education

The College awarded its first graduate degree in 1913. Today, ESF offers advanced degrees in six major program areas: environmental and forest biology, environmental and resource engineering, environmental science, forest chemistry, forest resources management, and landscape architecture. These programs are registered with the New York State Education Department.

Graduate study leads to the master of science degree, master of forestry degree, master of landscape architecture degree, and doctor of philosophy degree. A postdoctoral study program, closely related to the College's research effort, is also available.

Degree Programs and Areas of Study

The College is authorized to award degrees in the following programs. Enrollment in other than registered or otherwise approved programs may jeopardize a student's eligibility for certain financial aid programs.

Division of Engineering, page 57.

Environmental and Resource Engineering: M.S., Ph.D., with option in *forest engineering* and areas of study in environmental management, forest engineering, geo-spatial information systems, photogrammetry and remote sensing, or water resources engineering; option in *paper science and engineering* and areas of study in chemistry of pulping and bleaching, colloid chemistry and fiber flocculation, fiber and paper mechanics, process

and environmental systems engineering, or pulp and paper technology; and option in *wood products engineering* with areas of study in wood science and technology, wood anatomy and ultrastructure, tropical timbers, wood treatments, or engineered wood products and structures: timber structure design. (HEGIS Code 0999)

Division of Forest Resources, page 63.

Dual Program in Environmental and Forest Biology/Resources Management: B.S. (HEGIS Codes 0999 and 0115)

Faculty of Chemistry, page 66.

Chemistry: B.S., with options in biochemistry and natural products, environmental chemistry, or natural and synthetic polymer chemistry. (HEGIS Code 1905)

Forest Chemistry: M.S., Ph.D., with areas of study in biochemistry, environmental chemistry, organic chemistry of natural products, or polymer chemistry. (HEGIS Code 1905)

Faculty of Environmental and Forest Biology, page 72.

Environmental and Forest Biology: B.S., with elective concentrations in ecology, entomology, environmental microbiology, fish and wildlife biology and management, pest management, forest pathology and mycology, plant physiology, plant science, premedical science, science education, or zoology. An accelerated B.S./M.S. track in plant biotechnology is also available. (HEGIS Code 0499)

Environmental and Forest Biology: M.S., Ph.D., with areas of study in ecology, entomology, environmental physiology, fish and wildlife biology and management, forest pathology and mycology, plant science and biotechnology, soil ecology, or chemical ecology. (HEGIS Code 0499)

Faculty of Environmental Studies, page 80.

Environmental Studies: B.S., with areas of study in information and technology, land use planning, biological science applications, policy and management. (HEGIS Code 0201)

Graduate Program in Environmental Science: M.S., Ph.D., with areas of study in environmental land planning, environmental policy and democratic processes, environmental modeling and risk analysis, or water resource management. (HEGIS Code 0420)

Faculty of Forest Engineering, page 86.

Forest Engineering: B.S. (HEGIS Code 0999)

Faculty of Forestry, page 89.

Forest Technology Program: A.A.S. (HEGIS Code 5403)

Resources Management—General Forestry: B.S., with a minor in management (HEGIS Code 0115)

Forest Management and Operations: M.F., with areas of study in the public sector, or the private sector. (HEGIS Code 0115)

Forest Resources Management: M.S., Ph.D., with areas of study in policy and administration, forestry economics, forest management, recreation management, watershed management/hydrology, silviculture, silvics, forest soil science, tree improvement, international forestry, urban forestry, quantitative methods, or resources information management. (HEGIS Code 0115)

Faculty of Landscape Architecture, page 105.

Landscape Architecture: B.L.A. (HEGIS Code 0204)

Landscape Architecture: M.L.A. (HEGIS Code 0204)

Faculty of Paper Science and Engineering, page 112.

Paper Science and Engineering: B.S., with options in science, or engineering, and a minor in management. (HEGIS Code 0999)

Faculty of Wood Products Engineering, page 118.

Wood Products Engineering: B.S., with options in construction, or wood products. (HEGIS Code 0999)

Research

The College's commitment to scientific inquiry stretches back to its second year of existence. In 1912, Dean Hugh P. Baker initiated the College's first research project by joining forces with the U.S. Forest Service in a study designed to determine the species and quantities of wood being used by firms in New York State.

Since that date, ESF's research programs have attracted a worldwide clientele of industrial, governmental, professional, and scientific groups, and through liaison with them, the program maintains its vigor and relevancy to the world's most important environmental issues. Support from this clientele amounts to more than $5 million per year.

Students and faculty from across the College contribute to the depth and diversity of the research program. Findings from these studies are applied to a host of issues and problems through various demonstrations and communication networks. Recent examples include studies of the following: the impact of acid precipitation on forest ecosystems, the restoration of the lynx in the Adirondacks, the development of a system for integrating wildlife with forest management, the natural production of migratory fish in lakes and streams, the development of a forest resource management and planning support system, new wood pulping and bleaching processes leading to pollution-free water and air effluents, the development of polymeric materials for artificial human organs, and the evaluation of a radio-frequency drying method for lumber.

Empire State Paper Research Institute

The Empire State Paper Research Institute (ESPRI) is a worldwide research organization in the pulp and paper field. It performs investigations in cooperation with the Empire State Paper Research Associates (ESPRA), which is comprised of 73 pulp and paper companies in 14 countries. The Institute was established in 1945 when the members of ESPRA recognized the need for new scientific and technical knowledge and methods, and since then ESPRI has been able to maintain an efficient balance between the practical and theoretical bases of the pulp and paper industry.

The institute is housed in the modern J. Henry Walters Hall, which has its own pilot paper mill, and staffed by scientists who are internationally recognized for their accomplishments. The institute provides a research base for long-range industry development, and its program has widened in scope to cover nearly every aspect of pulping and papermaking, including additive retention, oxygen pulping and bleaching, effluent control, sheet drying, printability, and energy efficiencies.

Polymer Research Institute

Scientists at the College have made many original contributions to the field of pure and applied polymer chemistry, including the development of living polymers, the study of anionic polymerization and electron-transfer initiation, and work on the permeation of gases and films through polymeric films.

The College faculty specializing in polymer chemistry has trained hundreds of graduates and postdoctoral researchers, many of whom now hold leading positions in universities and industrial and governmental laboratories.

N. C. Brown Center for Ultrastructure Studies

The N.C. Brown Center, located in Baker Laboratory, is a teaching, research, and service facility. It is equipped to provide students, faculty, and research staff with virtually every type of modern microscopy, including light microscopy, video microscopy, scanning electron microscopy, and transmission electron microscopy.

Among the major items of equipment in the Center are the following: a JEOL 2000EX 200-KV transmission electron microscope; an RCA EMU-4A transmission electron microscope; two ETEC Autoscan scanning electron microscopes with energy dispersive x-ray analyzer, wavelength x-ray analyzer, LeMont Scientific Image Analysis System, and microstages for mechanical testing of specimens within the scanning microscope chamber; high vacuum evaporators; microtomes; ultramicrotomes; and an array of specialized light microscopes, including a high resolution enhanced contrast video microscopy system.

The center's resources include specimen preparation rooms, photographic darkrooms, three electron microscope laboratories, and other supporting facilities. The primary service of the center is teaching, and course offerings include microscopy and photomicrography, scanning electron microscopy, transmission electron microscopy, and interpretation of ultrastructure. Research is a second major function, and the center provides support to students, research staff, and faculty who are conducting structural studies. Public service is extended to industry, regional medical facilities, and colleges, as well as to local high school groups and technology-oriented organizations.

Adirondack Ecological Center

The Adirondack Ecological Center (AEC) is located on the Huntington Wildlife Forest in the geographic center of the 6 million-acre Adirondack Park wilderness. The AEC provides a support base for ecological research in the region, including

housing, laboratory, computer, and library facilities.

A resident staff maintains an extensive historical database and conducts continuous monitoring of environmental variables, such as weather and atmospheric chemistry, vegetation, and wildlife populations. Currently, more than 100 students and scientists are conducting research at the center, and the projects range from the effects of acid precipitation on tree growth to restoration of moose and lynx populations in the Adirondack region. Most research is conducted by graduate students, but undergraduates are encouraged to become involved as seasonal field assistants. Between 40 and 60 students are in residence at various times throughout the year.

The Huntington Wildlife Forest, a 15,000-acre property owned by the College, provides an exceptional resource for experimentation in ecology and natural resources management. The forest contains Rich Lake and the new $1 million Adirondack Interpretive Center, which is operated by the Adirondack Park Agency and open to the public throughout the year.

Great Lakes Research Consortium

The Great Lakes Research Consortium (GLRC) involves 10 educational institutions in a collaborative effort to understand and improve the Great Lakes ecosystem. Headquarted at ESF, the consortium's other member institutions are the SUNY Colleges at Brockport, Buffalo, Fredonia, Geneseo and Oswego; the SUNY Centers at Buffalo and Albany; and Clarkson and Cornell universities. Six universities in the province of Ontario, Canada, also participate in the consortium.

The consortium's goals are to facilitate research and scholarship involving Great Lakes issues, the education of students on topics related to the Great Lakes ecosystem, and the dissemination of information gathered through consortium-sponsored research. The GLRC sponsors scholarly workshops, a cooperative grants program, a seminar series, a database of New York Great Lakes scientific and scholarly work, and a newsletter.

Tropical Timber Information Center

The Tropical Timber Information Center (TTIC) provides identification of wood samples and information about general characteristics and technical properties of the world's timber. These services are directed toward the needs of importers and users of tropical woods.

The center began operation in 1975 as part of the Faculty of Wood Products Engineering, and is one of only two such sources of information in the western hemisphere. The center also carries out special studies under contract for production of data that is not available in the literature. The technical base for operation of the TTIC is the 35,000-specimen H.P. Brown Memorial Wood Collection of authenticated wood samples in the Faculty of Wood Products Engineering, and an extensive collection of reference materials in Moon Library. Both of these resources have been built up over the past 60 years by close cooperation with institutions throughout the world. Primary efforts at the center include responding to requests for services from users of tropical woods, expanding the collection, and developing an advanced computer system on properties and uses of the world's timbers.

The New York State Center for Hazardous Waste Management

The College is a partner in the New York State Center for Hazardous Waste Management, which is centered at SUNY Buffalo. The organization's long-term research and development goals include developing cost-effective technologies for neutralizing, recycling, or otherwise securely containing hazardous substances, and developing improved methods of safely storing and transporting toxic substances.

Faculty and staff at ESF represent an interdisciplinary group with expertise in areas that include biochemical toxicology, microbiology, environmental chemistry, sludge management, microbial ecology, and implementation considerations, including engineering and management components.

The College also publish the center's Waste Management Research Report, which is printed three times per year.

Cellulose Research Institute

The Cellulose Research Institute is currently focusing its efforts on the fine structure of native cellulose and its transformations into other commercially important forms of cellulose.

For example, the structural differences between native and regenerated celluloses have been determined, for the first time, through X-ray crystallographic studies. The same techniques are now being used to study the structural aspects of cellulose mercerization, an important commercial process in cellulose chemistry. Other recent research has been concerned with the organization, chemical

composition, and function of the vascular cambium in trees, which is the ultimate source of all wood and bark produced in nature.

U.S. Department of Agriculture Forest Service Cooperative Research Unit

The Northeastern Forest Experiment Station of the U.S. Forest Service maintains a research center at the College. Since 1978, the Cooperative Research Unit has been conducting research on urban environmental forestry problems. The center's efforts provide increased opportunities for faculty and students to collaborate with Forest Service scientists in studies of urban and environmental problems.

Graduate Education and Research Initiative

Governor Mario Cuomo and the New York State Legislature have supported the Graduate Education and Research Initiative (GERI), which is designed "to retain and attract premier faculty and graduate students, secure outside governmental and corporate support, and develop a university climate that spawns creativity."

To maximize the return on the state's contribution, SUNY's eight doctoral-granting campuses each have identified those centers of excellence or targets of opportunity in which they can make the most significant advances in research and graduate education and which hold the greatest potential for attracting additional resources to the State of New York. By focusing limited funds on carefully selected centers of excellence, the participating institutions maximize their contributions to the achievement of the initiative's broader goals, while remaining responsive to the needs of the specific areas they serve.

The College has advanced four programmatic themes: biotechnology in forestry, environmental systems science, polymer science and technology, and process engineering.

Biotechnology in Forestry

The biotechnology in forestry initiative is committed to the pursuit of excellence in graduate education and research in the general area of study, and to forging links with industries and governmental agencies concerned with forest biotechnology. The initiative is a multidisciplinary effort by the faculty of these four graduate programs: environmental and forest biology, forest chemistry, forest resources management, and environmental and resource engineering. A major objective is to develop practical research to help meet state and national needs in forestry and forest product utilization.

An accelerated B.S./M.S. track in plant biotechnology in the environmental and forest biology graduate program, or an M.S. in one of the four graduate programs or a related discipline, can be followed by a Ph.D. program. Graduate research assistantships are available for outstanding students in fields related to forest biotechnology.

Under the initiative, research and its applications are focused on plant molecular biology; plant and pest interactions including fungi, bacteria, viruses, mycoplasma-like organisms, and insects; biomass and xenobiotic conversions; and forest products and productivity.

Faculty areas of research include the following: molecular taxonomy; transformations of trees and fungi; multicopy gene variability; molecular ecology and chemical messengers; molecular biology of fungi; construction of DNA vectors; fungal dsRNA and pheromones in biological control; *in vitro* selection for disease resistance; mechanisms of pathogenicity and disease resistance and their genetic control; tissue, shoot, protoplast, and single cell culture; bioconversion of lignocellulose and hemicelluloses; enzymatic photostabilization of paper pulp; microbial detoxification of hazardous wastes; trace metal metabolism by phytoplankton; microbial treatment of wastewater; and selection and breeding for wood quality, growth rate, and disease resistance.

Available facilities include: newly remodeled and equipped molecular biology research and teaching laboratories, a tissue culture clean room, controlled environment chambers, modern air-conditioned glasshouses, NMR and GC-mass spectrometers, HPLCs, fermentation systems, and radioisotope and ultrastructure laboratories. Access to the cell sorter and DNA and peptide synthesizers and sequencers at Syracuse University is also available.

Environmental Systems Science

Environmental systems science is the quantitative and integrative study of physical, chemical, biological, and social-economic processes and mechanisms applied to ecosystems. It is integrative because it draws from faculty and research activity in the Faculties of Chemistry, Environmental and Forest Biology, Environmental Studies, Forest Engineering, and Forestry.

The approach of the Faculty of Chemistry to environmental systems science emphasizes interactions between environmental processes and

chemical elements and species in environmental systems. Current studies include behavior of trace organic contaminants in the Great Lakes, trace metal uptake by phytoplankton, characterization of natural organic compounds in water, identification and characterization of air and water particles, and development of improved sampling and analytic methods for air and water.

The Faculty of Environmental and Forest Biology stresses ecosystem analysis and modeling. The diverse faculty has particularly strong backgrounds within the northern hardwood forests, tropical forests, temperate and tropical rivers, lakes and wetland ecosystems. Specific research projects related to systems ecology include the following: nutrient flows in Adirondack ecosystems; changing tree species dynamics related to changing patterns of climate, precipitation chemistry and pathogens; long-term ecological research on disturbance and recovery in the Caribbean National Forest; phosphorus dynamics linking rivers and lakes in both upstate New York and Montana; and procedures for enhancing the recovery from disturbance of ecosystems in both the Adirondacks and in India.

The approach of the Faculty of Environmental Studies to environmental systems science stresses sustainable development as a basic concept, environmental information systems as a means for organizing environmental data, and environmental program analysis as a critical review of environmental policy programs. Current research revolves around international applications of integrated environmental planning, wetland systems assessment and evaluation, cross-cultural environmental perception, and environmental information system utilization and accuracy.

The approach of the Faculty of Forest Engineering to environmental systems science emphasizes hydrology and water resources, including wastewater engineering, and geo-spatial modeling and analysis. Current research activity is focused on remote sensing, digital image measurements, air photo analysis, water quality analysis, modeling and treatment, and solid/hazardous waste systems analysis and treatment.

The Faculty of Forestry stresses resources information management, forest growth modeling and silviculture, forestry economics and policy analysis, and urban greenspace systems ecology. Current research includes studies of forest soil and site productivity, remote sensing and geographic information systems application to forest management, exurban, urban and wildland-urban interface management and silviculture, and the impact of acidic deposition on forest soils.

Polymer Science and Technology

The Polymer Research Institute, a SUNY system-wide polymer research center located in the Faculty of Chemistry, provides the site, resources, and program for scientific research in which graduate students conduct their experimental studies, and the chemistry faculty supervises the graduate education for M.S. and Ph.D. degrees.

Research areas in polymer science available through the institute and supported by GERI include the following: ion-conducting polymers (polymer electrolytes), functionalized polysiloxanes, X-ray contrast polymers, and ring-opening polymerizations of cyclic siloxanes; theoretical studies on elastomers and polymer rubbery state, theory of stress-induced crystallization; new methods of polymer synthesis, stepwise polymerization, synthesis of temperature stable polymers; polymer blends, alloys, and solid phase multicomponent miscible systems; and polymer membranes for gas and liquid separations.

Also under study are the structure, morphology, and dynamics of polysaccharides by diffraction analysis and molecular modeling; use of solid-state NMR methods for studying both the static and dynamic aspects of polymer structure, the interrelation of structure in solid and liquid phases, and the production and characterization of microbial-origin biopolymers; and enzymatic corrosions of biomass to useful products.

Process Engineering

Serving as a bridge between science and technology, process engineering creates practical applications from scientific discoveries, providing the means for converting material resources into useful products. Design, control, and optimization of manufacturing units and systems are key elements of process engineering, while increased attention is given to energy efficiency and waste reduction, and extensive use of computer simulation both in research and practice.

At ESF, activity in process engineering is centered in the Division of Engineering, and is strengthened by long-standing ties with forest products industries through units such as the Empire State Paper Research Institute. However, process engineering relates closely to all of the Faculties and institutes of the College, and links and stimulates the applied aspects of the other three specialties in the GERI program. As this program progresses, ESF aims to become a major center of education and research in process engineering.

Public Service

No one is educated for life — education is a lifelong pursuit. Every year more people find they must return to the classroom for professional upgrading, retraining, and personal enrichment.

In an age where information and technological advancement are replacing industrial goods as the major products, it is more urgent than ever that continuous education, technological transfer, and retraining are made available to everyone.

Since its inception, ESF has held public service as a crucial mission. This mission was reaffirmed and strengthened during the 75th Anniversary of the College in 1986. The College offers a wide variety of learning experiences and reaches out to people with specific learning needs through its Office of Continuing Education.

Serving New York Citizens

The educational needs of New York citizens reflect the trends of our changing times. As research and education lead to an increasingly technological society, our growing sophistication increases concerns about the safety of our environment. As urbanization continues, use and ownership of our agricultural and forested lands leaves traditional hands. As increased leisure time and travel boost our demand for recreational facilities, our land and water suffer under competing uses. As the state strives to balance natural resource utilization with environmental protection, the need grows for people educated in environmental science and forestry.

Continuing Education

The Office of Continuing Education extends the resources and knowledge found at the College to the family of New York. Credit courses, shortcourses, symposia and seminars on subjects related to the ESF curriculum are presented to a wide variety of audiences.

Working in cooperation with government agencies at all levels, professional groups, and representatives of business and industry, the Office of Continuing Education provides opportunities for continuing and professional education by designing courses at the theoretical and applied, basic and advanced levels.

The courses attract participants from both the public and private sectors representing local, regional, national, and international interests. Audiences include environmental consultants and engineers; forest owners, managers, and operators; scientists and researchers; wood and construction engineers; paper products manufacturers and researchers; conservation and recreation personnel; wildlife managers; landscape architects and local and regional planners; and citizen action committees.

The College's continuing education programs include credit or noncredit courses arranged on campus or for off-campus sites, and designed to meet the needs of busy adults by varying in length from hour-long seminars to full-semester graduate level courses.

Community Education

Continuing education also provides personal enrichment for members of the local community. The unique expertise of the College faculty is extended to the community through public shortcourses, lecture series, and forums. Community members are invited to make recommendations for continuing education activities.

Conference Services

The College provides conference services for meetings of professional associations, technical and academic societies, government, industry, environmental, and community organizations, and other groups whose interests correspond with the mission of the College. The Office of Continuing Education has coordinated programs ranging from small seminars to week-long international meetings at locations ranging from urban campuses, conference centers and hotels to rustic retreats.

The College can provide meeting facilities for groups of up to 450. Through its ties with Syracuse University and area hotel convention sites, groups of 2,000 or more can be accommodated. Depending upon availability, a complete range of conference services from meeting rooms and audio-visual services to lodging and catering is available.

The College's regional campuses — in the Adirondacks at Wanakena, Newcomb and Warrensburg, and in western New York at Allegany State Park — are also attractive sites for conferences. Inquiries about facilities, services, and costs are invited.

Nonmatriculated Students

Most of the credit courses offered at ESF are available to students not enrolled in a degree program. By registering through the Office of Continuing Education, a student may develop additional expertise in a professional area, earn credit toward a degree at another college or university,

develop the prerequisites necessary to enter more advanced courses at ESF or elsewhere, or sample courses as an aid to determining a future major or career.

Other Public Services

The College, throughout its history, has continued to respond to its specific legislative mission in the area of public service. The principal formal public service activities include community education and information, technical advice and guidance to local, state, and federal agencies and organizations, and technical assistance to the forest and wood-using industries.

The complete list of ESF's public service contributions is lengthy, but two examples are the Tree Pest and Disease Service, which provides technical advice to private citizens and to governmental agencies, and the participation of faculty in Central New York's Poison Control Center. Altogether, the College's public service programs reach approximately 1 million New York residents each year.

Admissions

Undergraduate Admissions

The College is well known for the high quality of its undergraduate instruction and unique teaching facilities, and admits well-qualified students at the freshman, sophomore, and junior levels. Several factors are considered before students are accepted for admissions at any level. These factors include their academic preparation, personal motivation, chosen major, and reasons for wanting to study at ESF.

Applying for Admissions

Students admitted to the College can be divided into four groups:

1. Freshman admissions (regular or early decision);
2. Advanced early admissions;
3. Transfer admissions;
4. Deferred admissions.

Each entrance category requires the applicant to have a specific academic background, and to have maintained a satisfactory grade point average.

Applications for admissions to the College are available through all New York State high schools, and other SUNY admissions offices. An application package may also be obtained directly from the ESF Office of Undergraduate Admissions.

Freshman Admissions

The College enrolls a limited number of students directly from high school. This freshman enrollment option is available for students who meet the selective admissions standards, and choose one of the following majors:

1. Chemistry;
2. Environmental and forest biology;
3. Forest engineering;
4. Paper science and engineering;
5. Resources management (general forestry);
6. The dual program (combining biology and forestry).

Successful freshman applicants should present outstanding academic credentials from high school. Four units each of college preparatory mathematics and science, including chemistry and/or physics, are recommended. Applicants are required to forward the results of either the SAT or ACT examination. Achievement tests for the SAT are not required, but in some cases they may highlight the special talents of an applicant.

Freshman applicants are also required to write an essay. The writing sample must be submitted on a supplemental admissions form that can be obtained from the Office of Undergraduate Admissions, and is to be returned directly to that office. In addition, freshman applicants are encouraged to have an on-campus interview to improve their understanding of the College and its academic programs.

Since ESF cannot offer admission to all freshman applicants, it reserves the right to offer delayed admission to students who are not prepared to enroll directly after high school. These applicants are offered a guarantee of admissions to ESF for either their sophomore or junior year of college under the assumption they will satisfactorily

Application Filing Dates

	Enrollment Option	Recommended Date
Freshman:	Fall enrollment, early decision	November 15
	Fall enrollment, regular admission	March 1
Transfer:	Fall enrollment	May 1
	Spring enrollment	December 1

Prospective students are strongly urged to submit their applications earlier than the recommended date to reduce the possibility they will be placed on an admissions waiting list.

complete their freshman year or freshman and sophomore years at another college.

Applicants for freshman admission who are sure that ESF is their first choice should apply under the early decision option. Early decision candidates must have a completed application on file by November 15. This must include the supplemental admissions form obtained from the Admissions Office, results of either an SAT or ACT examination, an essay, and the State University of New York application.

All early decision candidates will be notified of whether they have been accepted by December 15. Those accepted will be notified of their preliminary financial aid package by January 15. Under this enrollment option, accepted candidates must agree to withdraw their applications from other colleges once they receive their financial aid package from ESF.

Advanced Early Admissions

The College also recognizes that some students have made arrangements to spend some portion of their first two years of college at other institutions, and will transfer to ESF in either their sophomore or junior year. To facilitate this process and reduce difficulties associated with transferring, ESF has established an advanced early admissions (AEA) option.

Under this option, students are guaranteed admission to ESF for either their sophomore or junior year. These students benefit from long-term academic advising to ensure they meet all academic requirements for transferring to the College. Students accepted under the AEA option also receive special mailings and invitations to participate in activities on the ESF campus.

High school seniors who would like to enroll in environmental studies, landscape architecture, or wood products engineering, in particular, are encouraged to apply to the College under the AEA option to improve their chances of being admitted to ESF for their junior year of college.

Transfer Admissions

The largest number of students who enroll at the College transfer to ESF after spending one or two years at another college.

Unless guaranteed admission under the standards of the AEA option, the admissibility of transfer students is based primarily on the distribution of their previous coursework, overall academic performance, and specific interest in ESF programs. Consideration is given to both the quality and appropriateness of the students' prior academic experience, and for most programs a significant emphasis is placed on mathematics and science.

Students who apply to ESF are expected to follow the prescribed set of prerequisite courses appropriate to their intended major at the College. Each curriculum offered at ESF and listed in this catalog defines the required courses necessary to be considered for admission. To be considered for admission to ESF, a transfer student must have a minimum grade point average of 2.000 (A=4.000) at the last institution where the student was enrolled full-time.

For transfer students, it is expected that courses taken at other colleges will be completed at institutions that are accredited by one of six regional accrediting agencies. These are the Middle States Association of Colleges and Schools, New England Association of Schools and Colleges, North Central Association of Colleges and Schools, Northwest Association of Schools and Colleges, Southern Association of Colleges and Schools, and Western Association of Schools and Colleges.

Forest Technology Admissions

The New York State Ranger School does not enroll freshmen, but candidates may apply for acceptance into the forest technology program either under the advanced early admissions option or as a transfer student.

High school students who want to enroll in this program should apply during their senior year to receive a guarantee of an entry date one year later. For example, high school students in the class of 1992 should apply during their senior year for admission to the Ranger School in 1993. For further information on the New York State Ranger School, see page 101or contact the ESF Office of Undergraduate Admissions.

Deferred Admissions

Students accepted to ESF who want to defer their enrollment for one or two semesters beyond their original entry date must make this request in writing directly to the Office of Undergraduate Admissions. Those students will receive written notification if their request has been approved. A $100 non-refundable advance deposit fee is required for deferred enrollment, and will be applied to future tuition charges.

Campus Visits

The College welcomes visitors to its campus. Prospective undergraduate students who wish to meet with a member of the admissions staff, take a campus tour, or possibly meet with a member of the faculty are asked to make an appointment through the Office of

Enrollment Options

ESF Major	Freshman	Sophomore	Junior
Bachelor of Science			
Environmental and forest biology	X		X
Resources management (forestry)	X		X
Dual (biology and forestry)	X	X	X
Chemistry	X	X	X
Paper science and engineering	X	X	X
Forest engineering	X	X	X
Wood products engineering			X
Environmental studies			X
Bachelor of Landscape Architecture			
Landscape architecture			X
Associate in Applied Science			
Forest technology		X	

Undergraduate Admissions.

Admissions staff are available for appointments from Monday through Friday between 9 a.m. and 3 p.m., while tours led by ESF students are provided by the admissions office most weekdays from 10 a.m. until 2 p.m.

Cooperative Transfer Programs

The College has developed pre-environmental science and forestry transfer programs with 58 other colleges both in and out of New York State. These programs offer high school students a wide selection of colleges from which they can obtain the necessary lower division courses, and appropriate advice on how to prepare for ESF.

These institutions represent a broad spectrum of higher education, including private, public, two- and four-year colleges in Alabama, Connecticut, Maryland, Massachusetts, New Jersey, Pennsylvania, and Rhode Island, as well as New York. Students who attend these colleges and follow a program prescribed by ESF will share a common academic background with other students who transfer to the College.

The cooperative colleges are the following:

New York State Colleges

Adirondack Community College, Glens Falls
Broome County Community College, Binghamton
Canisius College, Buffalo
Cayuga County Community College, Auburn
Clinton County Community College, Plattsburgh
Columbia-Greene Community College, Hudson
Community College of the Finger Lakes, Canandaigua
Corning Community College, Corning
Dutchess County Community College, Poughkeepsie
Erie County Community College, Buffalo
Herbert H. Lehman College, the Bronx
Herkimer County Community College, Herkimer
Hudson Valley Community College, Troy
Jamestown Community College, Jamestown
Jefferson County Community College, Watertown
Kingsborough Community College, Brooklyn
Le Moyne College, Syracuse
Mohawk Valley Community College, Utica

Monroe County Community College, Rochester
Nassau County Community College, Garden City
Niagara County Community College, Sanborn
North Country Community College, Saranac Lake
Onondaga County Community College, Syracuse
Orange County Community College, Middletown
Rockland County Community College, Suffern
St. John Fisher College, Rochester
Siena College, Loudonville
Suffolk County Community College, Selden
Sullivan County Community College, Loch Sheldrake
SUNY College of Technology at Alfred
SUNY College of Technology at Canton
SUNY College of Agriculture and Technology at Cobleskill
SUNY College at Cortland
SUNY College of Technology at Delhi
SUNY College at Geneseo
SUNY College of Agriculture and Technology at Morrisville
SUNY College at New Paltz
SUNY College at Oneonta
SUNY College at Oswego
Syracuse University
Tompkins-Cortland Community College, Dryden
Ulster County Community College, Stone Ridge
Westchester County Community College, Valhalla

Out-of-State Colleges

Allegany County Community College, Cumberland, MD
Berkshire Community College, Pittsfield, MA
Bishop State College, Mobile, AL
Camden County College, Blackwood, NJ
Garrett Community College, McHenry, MD
Holyoke Community College, Holyoke, MA
Housatonic Community College, Bridgeport, CT
Keystone Junior College, LaPlume, PA
Middlesex County Community College, Edison, NJ
Montgomery County Community College, Rockville, MD
Northampton Community College, Bethlehem, PA
Ocean County College, Toms River, NJ
Roger Williams College, Bristol, RI
Tuskegee University, Tuskegee, AL
Union College, Cranford, NJ

Transfer Credit

Credit hours appropriate to the ESF curriculum can be transferred to the College, but grades and grade points cannot be transferred. Courses to be transferred as required courses within a curriculum must be acceptable in content, and credit will be awarded only for those completed with a passing grade.

All transfer credit will remain tentative until official, final transcripts are received and reviewed by Office of Undergraduate Admissions staff. It is the student's responsibility to ensure that official, final transcripts are sent to and received by the College.

College Credit By Examination

The College will consider for credit the results of examinations from standardized testing agencies such as the College Entrance Examination Board's Advanced Placement (AP) or College Level Examination Programs (CLEP).

For freshman applicants, any AP examination score of 3 or higher or any CLEP examination in the 50th percentile or higher will be considered for credit. For transfer students, ESF will generally accept the same credit as was granted by the transferring college for AP and CLEP results. Further information is available from the Office of Undergraduate Admissions.

Educational Opportunity Program

The State University of New York recognizes that providing access to an educational opportunity for all state residents means being sensitive to the educational needs of people with varying social, cultural, educational, and economic backgrounds.

The Educational Opportunity Program (EOP) is an academic and financial support program offered at ESF and other SUNY campuses to provide a college education for capable students who have not had the same opportunities as other students to realize their academic potential because of limited financial resources and inadequate academic preparation. The program is not designed for students who need only financial assistance.

The basic goal of the EOP program at the College is to provide qualified students with a college education and the opportunity for personal growth and professional development. Counseling, financial assistance, and tutoring are provided on an individual basis.

To qualify, students must be New York State residents and demonstrate the potential to successfully complete a course of study at the College.

High school seniors who want to apply for freshman enrollment and EOP status at the College must file a SUNY application form with their high school guidance counselor, and indicate they want to be considered for EOP. In addition, they must file a Family Financial Statement directly to the Financial Aid Office at ESF.

In order for transfer students to participate in

the program at the College, they must have been enrolled in an EOP, Higher Education Opportunity Program (HEOP) or Search for Education Elevation and Knowledge (SEEK) program at their prior college. Therefore, students who are applying to ESF as high school seniors through the advanced early admission option, should also apply for EOP, HEOP or SEEK at their lower division college, and must enroll in such a program in order to continue in EOP at ESF.

For further information, contact the Director of the Educational Opportunity Program at the College.

Medical Examination

Each new student is required to submit a medical history and physical examination report on a form that will be sent to the student after the initial acceptance notice.

Graduate Admissions

Admission into a program of graduate study requires the review and acceptance of an applicant's credentials by appropriate faculty members, and the recommendation of the appropriate Faculty Chair to the Dean of Instruction and Graduate Studies.

Minimum requirements are a bachelor's degree from a recognized institution, and in most cases an academic record showing at least a B average for junior and senior years of the baccalaureate program or for the master's program.

Also required are Graduate Record Examination (GRE) scores, and for some degree programs advanced test scores, supporting letters of recommendation, and a statement of educational and professional goals. The GRE scores may be waived by a Faculty on an individual basis.

A non-refundable $35 application fee is charged.

GRE Advanced Tests

Subject matter advanced tests are required by the following programs:

Graduate Program	*Advanced Test*
Chemistry	Chemistry
Chemistry (biochemistry area of study)	Chemistry or Biology
Environmental and forest biology	Biology

Procedure

The College provides an application form for graduate admissions. Requests for information and applications should be addressed to the Office of Instruction and Graduate Studies.

The GRE and Test of English as a Foreign Language (TOEFL) examinations are offered several times each year in major cities of the world. For information on the examinations, write to the Educational Testing Service, Princeton, New Jersey 08540. In submitting test scores to the College (**institutional number R2530**), request they be sent to the Office of Instruction and Graduate Studies.

International Students

The College enrolls international students on the undergraduate and graduate levels if they satisfy the admission requirements outlined throughout this section of the Catalog.

In addition to the requirements that all prospective students must meet, international students must provide evidence of the following:

1). Proficiency in the English language through acceptable performance on either the Test of English as a Foreign Language (TOEFL) or the College Entrance Board Achievement Test in English (scores of 550 or higher on either test are required), or by completing at least two years of college at an institution where the courses were taught in English;

2). Ability to meet all of the financial obligations which will be incurred while attending the College.

International students must also file the State University of New York Foreign Student Admission forms. No fee is required for processing these forms.

If accepted for enrollment, health and accident insurance supplied by the State University of New York must be obtained before the student will be allowed to register at the College. Further details about this policy are available from Syracuse University International Student Office, 310 Walnut Place, (315) 443-2457, or from the ESF Office of Student Affairs and Educational Services.

International students who are currently enrolled at an American college may apply for admission to ESF. In addition to the entrance requirements for other international students, they must obtain permission to transfer to ESF from the U.S. Immigration and Naturalization Service district office having jurisdiction over the college in which they are currently enrolled.

Expenses

The ESF tuition and College fee structure is set by the State University of New York Board of Trustees, and generally covers the costs associated with instruction and the use of facilities and services at the College.

Tuition

The tuition schedule per semester, listed below, is subject to change:

	NYS Resident Students	Out-of-State Students
Undergraduate Matriculated		
Full-time	$1,075	$2,875
Part-time	$90/credit hour	$240/credit hour
Graduate Matriculated		
Full-time	$1,600	$3,258
Part-time	$134/credit hour	$274/credit hour
Continuing Education Non-Degree Students without a Baccalaureate Degree		
Course Nos. 0-599	$90/credit hour	$240/credit hour
Course Nos. 600-999	$134/credit hour	$274/credit hour
Students with a Baccalaureate Degree		
Course Nos. 0-499	$90/credit hour	$240/credit hour
Course Nos.500-999	$134/credit hour	$274/credit hour
Maximum Total Tuition for 12 credit hours or more:	$1,600	$3,258

Residency

For purposes of tuition, "residence" refers to the principal or permanent home to which the student returns. Students who want to change their permanent residence may apply for a change in residency after they enroll at the College. Application forms are available in the Office of the Registrar.

Fees

Application

Students who apply for admission to an undergraduate program at any of the State University of New York units are charged a nonrefundable application fee of $25. For more information about the fee, and guidelines for exemptions, obtain the Application Guidebook for the State University of New York through any SUNY admissions office or any New York State high school.

Students who apply for admission to a graduate program at ESF are charged a nonrefundable application fee of $35.

College

The College fee is $12.50 per semester for full-time students, and 85 cents per credit hour for part-time students. For tuition purposes, students are considered full-time when they are enrolled in 12 credit hours or more.

Student Activities

Each full-time undergraduate student is charged $60 per year to cover the cost of student activities at

the College, while full-time non-matriculated students are charged $30 per semester, and part-time matriculated students are charged $1.50 per credit hour.

Full-time graduate students are charged an activity fee of $28 in the fall only. Part-time matriculated graduate students are charged $7 per semester. Full-time graduate students who enter ESF in the spring semester are charged a $7.50 student activities fee.

Students also pay an annual fee to Syracuse University to cover university-sponsored activities and services that are available to ESF students, but not duplicated at the College. These fees are $26.75 for full-time undergraduate students and $15 for full-time graduate students, and are charged in the fall only.

Part-time matriculated undergraduate students are charged $17.50 per year and part-time matriculated graduate students are charged $10 per year at fall registration only.

Syracuse University does not charge an activities fee for non-matriculated undergraduate or graduate students.

Student Support Services

All full-time students are charged $87.50 per semester to partially offset the cost of academic and other support services provided by Syracuse University, while part-time students are charged $7.50 per credit hour.

Final Year

A commencement fee of $14 is required at the beginning of the semester in which a student is expected to obtain a degree.

All undergraduates are also charged $15 for a school yearbook in the spring semester, and a $10 senior gift charge the semester they are expected to graduate.

Additional costs are incurred by graduate students for the binding, abstracting, and microfilming of theses, projects, and reports of professional experience.

International Student Health Insurance

All international students attending the College must participate in the State University of New York International Health Insurance Program. The cost is estimated to be $471 per calendar year. Coverage for dependents is available from the insurance carrier.

Terms of Payment

Undergraduate Deposit

All undergraduate students pay an advance payment deposit of up to $100 after they are admitted to the College. Information on when the deposit is due, as well as refund guidelines for the deposit, are sent to students after they accept an offer of admission. The deposit is credited to the students' first semester tuition. There is no advance payment deposit required for students accepted for graduate study.

Billing

Six weeks prior to the start of each semester, the College sends students expected to register for the upcoming semester a detailed invoice indicating the total amounts they are expected to be charged. This invoice includes only ESF charges. (See below for housing and board costs at Syracuse University). Payment is encouraged prior to the scheduled registration period, and must be made before the first day of classes. Detailed instructions are included with the invoice.

The College participates in deferred tuition payment plans, including Academic Management Services, Tuition Management Systems, and The Tuition Plan. The purpose of these plans is to allow students or parents to make tuition payments in monthly installments.

Refunds

A student who is given permission to cancel registration is liable for payment of tuition in accordance with the following schedule:

Liability During Semester	
1st week:	0%
2nd week:	30%
3rd week:	50%
4th week:	70%
5th week:	100%

Application for a refund must be made within one year after the end of the semester for which the tuition was paid to the College. The first day that classes are offered, as scheduled by the College, shall be considered the first day of the semester, and the first week of classes for purposes of refunds shall be deemed to have ended when seven calendar days, including the first day of scheduled classes, has elapsed.

There is no tuition or fee liability established for a student who withdraws to enter military service prior

to the end of a semester for those courses for which the student does not receive academic credit.

A student who is dismissed for academic or disciplinary reasons prior to the end of a semester is liable for all tuition and fees due for that semester.

A student who cancels registration at a unit of the State University of New York, and within the same semester registers at another unit of the state system is entitled to full credit for tuition and fees paid for that semester.

In situations where a student must withdraw from the College under circumstances in which the denial of a refund would create serious hardship, the bursar can waive the normal refund schedule. Such action can be taken if the student has completed no more than one-half of the semester and will not receive academic credit for the semester. A written request for relief from the provisions of the refund schedule, including the reasons for the student's withdrawal, must be submitted to the bursar.

Other Costs

Room and Board Costs

The College does not operate student residence or dining halls, but facilities are available at Syracuse University.

In general, housing costs at Syracuse University range from $1,325 to $1,695 per semester, reflecting the diversity of single- and multiple-room accommodations for graduate, undergraduate, single, and married students.

A variety of meal plan options are also available to all students, whether or not they reside in university residence halls. The costs of these plans range from $500 to $1,480 per semester. Payment for housing and meal plans is made directly to Syracuse University.

For more information about housing and meal options refer to the Student Life section of this catalog, and/or contact the Office of Residence Services, 202 Steele Hall, Syracuse University, Syracuse, New York 13244, (315) 443-2721.

Program Expenses

The cost of books and supplies is approximately $600 per year. Additional costs for personal expenses, clothing, and transportation vary greatly from student to student, but are estimated to range from $900 to $1,100 per year.

Several programs at ESF include additional costs. Students majoring in resources management attend a seven-week Summer Session in Field Forestry at the Wanakena Campus between the sophomore and junior years. Environmental and forest biology majors attend the summer field experience at the Cranberry Lake Biological Station at the end of their junior year.

The Wanakena session costs approximately $1,425, while the four-week program at Cranberry Lake costs between $875 and $1,295, plus travel and personal expenses.

Wood products engineering students take an extended field trip of up to two weeks at the end of their junior year at a cost of approximately $250.

Field trips for landscape architecture students range between $150 and $300. In addition, students enrolled in landscape architecture are required to spend one semester off campus. This is a self-designed and student-budgeted program. Costs do not necessarily exceed those of a semester on campus, but additional costs are often incurred depending upon the location chosen. These additional costs are the responsibility of the student, and are not covered by financial aid.

Financial Aid

The College offers these seven basic forms of student financial assistance: scholarships or grants; part-time employment; long-term loans; minority student scholarships and fellowships; assistantships, tuition scholarships, and fellowships for graduate students; a deferred tuition payment plan; and sources of non-need loans to parents.

Federal and state financial aid programs are for United States citizens, permanent residents, or holders of I-151 cards. These programs are coordinated to supplement parental support, summer work, savings, and assistance from other sources. The sources of funds for financial assistance programs, the guidelines for determining the recipients, the procedures for applying, and the method of disbursement of funds vary from one program to another. This information is presented in detail in Financial Assistance at ESF, which is a separate publication that is mailed to all applicants and is available through the Office of Financial Aid.

Most financial aid is awarded primarily on the basis of financial need. Some scholarships and fellowships, however, are based on other criteria, such as academic achievement or minority status. Assistantships, tuition scholarships, and fellowships for graduate students are not awarded based upon financial need.

In order for students to receive aid, they must be making satisfactory academic progress toward a degree.

Financial aid advisors are aware of the many problems of financing higher education and meeting day-to-day living expenses for both undergraduate and graduate students, and are available to discuss individual problems. All students are encouraged to apply for financial aid.

How to Apply

Students interested in receiving financial assistance, with the exception of graduate assistantships, tuition scholarships, and fellowships, must complete an application process each year that requires the filing of at least two forms. (See Graduate Assistantships below).

1. After January 1, students must complete the Family Financial Statement (FFS), and submit it to the American College Testing Company, Iowa City, Iowa 52243.
2. Students must also complete a College Aid Application and Financial Aid Transcript, and return it to the Office of Financial Aid by February 15 for early consideration or March 15 for regular consideration.

Applications will be accepted after March 15, but available funds may already be committed to other students. Prospective students do not need to receive notification of acceptance to ESF before applying for financial aid.

The necessary forms are available in the Office of Financial Aid, high school guidance offices, and many college financial aid offices. The College Aid Application and Financial Aid Transcript is also included in Financial Assistance at ESF.

Students are invited to discuss with the Financial Aid Office staff any problems they may have in financing their education. Applicants are also urged to contact the office for the latest information and requirements pertaining to financial assistance, because financial aid systems and forms frequently change.

Selection of Recipients

The primary consideration in determining which students will receive awards is comparative financial need. However, scholastic standing, citizenship, and potential contribution to the College community are also considered in making certain award decisions.

Verification of Information

All students who request financial assistance will be required to submit information about their family's and/or personal financial situation prior to aid disbursement. The College will request copies of parents' and/or students' federal tax forms, along with other statements which will be used to verify other sources of income, family size, number of dependents in college, and other pertinent information.

Failure to comply with a request to verify pertinent information will result in the cancellation of any aid offered, and the possibility of legal action being taken by the U.S. Department of Education.

Retention of State Awards

All students who are awarded financial assistance will be required to maintain satisfactory academic progress each semester in order to keep their awards. Academic progress standards for all awards provided

by New York State are listed below.

Recipients of a New York State award must adhere to the following state requirements:

1. Academic Progress — Students must meet the stated minimums on the following charts to be eligible for an award the next semester.

2. Program Pursuit — Students must complete a minimum number of credit hours each semester based on a full-time course load of 12 credit hours.

a. Associate in Applied Science degree students are required to complete 75 percent of the full-time credit load. Therefore, they must receive at least nine credits per semester. (.75 x 12 = 9).

b. Bachelor degree students must complete 100 percent of a full-time credit load each semester. Therefore, they must complete 12 credit hours each semester.

c. Graduate degree students must complete 100 percent of a full-time course load, or 12 credits, unless they have an assistantship. Graduate students with an assistantship should see the section on Credit Hour Load in the Graduate Academic Policies section of this Catalog for the definition of full-time status.

Waivers for New York Awards

Students who fall below the credit requirement may apply for a waiver. Students are allowed only one waiver during undergraduate work, and only one waiver during graduate work. A waiver will be granted only after the student and College officials agree that such an issuance is in the best interest of the student. Requests for waivers are made through the Director of Financial Aid.

Standard of Satisfactory Academic Progress for Purpose of Determining Eligibility for State Student Aid

Calendar: Semester **Programs: Associate Degrees**

Before being certified for this payment,	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
a student must have accrued at least this many credits	0	3	9	18	30	45	60	75
with at least this grade point average	.000	.500	.750	1.300	1.500	1.700	2.000	2.000

Noncredit remedial instruction can be counted toward a full-time academic load as set forth in 145-2.1 of the Commissioner's Regulations. The number of credits in this chart refers to work completed toward the degree.

Calendar: Semester **Program: Baccalaureate Degree**

Before being certified for this payment	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Tenth
a student must have accrued at least this many credits,	0	3	9	18	30	45	60	75	90	105
with at least this grade point average	.000	.500	.750	1.200	1.400	1.500	1.600	1.700	1.800	1.900

Noncredit remedial instruction can be counted toward a full-time academic load as set forth in 145-2.1 of the Commissioner's Regulations. The number of credits in this chart refers to work completed toward the degree.

Calendar: Semester **Program: All Graduate Level Programs**

Before being certified for this payment	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
a student must have accrued at least this many credits,	0	6	12	21	30	45	60	75
with at least this grade point average.	.000	2.000	2.500	2.750	3.000	3.000	3.000	3.000

Retention of Federal Awards

Undergraduate and graduate students must meet specified criteria in order to be eligible for Title IV Federal Student Assistance, which includes Pell Grants, Supplemental Educational Opportunity Grants, Perkins Student Loans, Stafford Loans, College Work-Study Programs, and Parent Loan for Undergraduate Students.

The criteria that students must meet to be eligible for Title IV student aid are the same criteria all ESF students must adhere to in terms of institutional academic policies, and specifically academic progress towards a degree.

The evaluation criteria are the following:

1. An appropriate grade point average to ensure satisfactory academic progress;
2. The successful accumulation of credits toward a degree;
3. Receiving a degree within the prescribed time limit for that program. (Limits vary for individual programs: see following tables).

Standard of Satisfactory Academic Progress for Purpose of Determining Eligibility for Federal Aid

Calendar: Academic Year **Program: Associate Degree**

Academic years completed at ESF	2	3
A student must have successfully completed this number of credit hours	45	76
with at least this cumulative grade point average	2.000	2.000

Calendar: Academic Year **Program: Baccalaureate Degree**

Academic years completed at ESF	1	2	3	4	5	6
A student must have successfully completed this number of credit hours	10	40	70	100	130	160
with at least this cumulative grade point average	2.000	2.000	2.000	2.000	2.000	2.000

Calendar: Academic Year **Program: All Master Level Programs**

Academic year completed at ESF	1	2	3
A student must have successfully completed this number of credit hours	15	27	42
with at least this cumulative grade point average	3.000	3.000	3.000

Calendar: Academic Year	Program: All Ph.D. Level Programs						
Academic year completed at ESF	1	2	3	4	5	6	7
A student must have successfully completed this number of credit hours	15	27	42	54	66	75	90
with at least this cumulative grade point average	3.000	3.000	3.000	3.000	3.000	3.000	3.000

Appeal, Probation, Reinstatement

Students who fall below the minimum standards may appeal to the Dean of Instruction and Graduate Studies to retain their academic eligibility to receive Title IV Federal Student Assistance. (See Academic Dismissal, page 32).

Appeals will be evaluated for mitigating circumstances such as injury or illness, and the likelihood that the student will be able to return to the appropriate standard. If the Dean of Instruction and Graduate Studies places a student on "academic probation," the student remains eligible for Title IV aid as defined by the statement of "Good Academic Standing." (See page 39).

The Office of Financial Aid will notify students via certified mail if they are in danger of losing financial assistance because they have fallen below academic standards.

Scholarship, Fellowship and Grant Programs

Supplemental Educational Opportunity Grants

The College receives Supplemental Educational Opportunity Grants (SEOG) authorized under Title IV-A of the Higher Education Act of 1965. These funds enable the College to award grants to undergraduate students who have financial need. Grants range from $100 to $4,000 per year.

Educational Opportunity Program

Students accepted into the College's Educational Opportunity Program (EOP) may receive, in addition to other financial assistance, a special award to pay for education-related costs. Students must come from a socio-economically and academically disadvantaged background to be eligible.

Prospective EOP students must apply for financial aid when submitting their admissions applications. (See Admissions, page 18).

Pell Grants

The Pell Program, formerly known as Basic Educational Opportunity Grants, was authorized in the Educational Amendments of 1972. Grants are available to eligible full-time and part-time undergraduate students, and can vary from $250 to $2,400.

Applications are available from high school guidance offices or any college office of financial aid. Interested students should submit the Student Aid Report (SAR) to the Office of Financial Aid as soon as it is received from the processor.

Tuition Assistance Program and Regents Programs

Tuition Assistance Program (TAP) awards are available to New York State residents who are enrolled in full-time degree programs. The awards are based on income, and range from $350 to full tuition.

Regents Grants or Children of Deceased or Disabled Veterans Grants are awarded to children of parents who served during specific periods of war or national emergency, and who died as a result of such service or suffered a disability of at least 50 percent. The awards entitle state residents who qualify to $450 per year.

Additional information and applications for these programs are available from the Office of Financial Aid, or from New York Higher Education Services Corporation, Tower Building, Empire State Plaza, Albany, New York 12255.

Vocational Rehabilitation Grants

Financial assistance and program counseling are provided by New York State for students with disabling conditions. Information is available from

any state Office of Vocational Rehabilitation.

Veterans' Benefits

The Veterans' Readjustment Benefits Act of 1966, as amended, enables veterans and children of deceased or disabled veterans to obtain financial aid for their college education.

Application forms and additional information and counseling are available from the ESF Veterans' Affairs Counselor in the Office of the Registrar, local veterans' administrations offices, and the State Regional Office, 111 West Huron Street, Buffalo, New York 14202.

Minority Student Scholarships and Fellowships

Undergraduates who are New York State residents who are Black/ Non-Hispanic, Hispanic, Native American, or Alaskan Native are eligible for scholarships comprised of funds from both the College and SUNY. Eligible students should contact the Office of Financial Aid.

Graduate students who are Black/ Non-Hispanic, Hispanic, Native American, or Alaskan Native and are also U.S. citizens or permanent residents are eligible for SUNY Underrepresented Minority Graduate Fellowships. Eligible students should contact the Office of the Dean of Instruction and Graduate Studies.

Assistance for Native American Students

Native American students with financial need may be eligible for scholarship and grant assistance through programs sponsored by the Federal Bureau of Indian Affairs and the New York State Education Department. For more information, students should contact the Bureau of Indian Affairs, 1951 Constitution Avenue NW, Washington, D.C., or the Native American Education Unit, State Education Department, Education Building Annex, Albany, New York 12234.

Private Fellowships, Scholarships, and Grants

The College administers a number of financial aid programs established by private individuals, companies, organizations, and foundations. These scholarships and grant programs have varying eligibility requirements and are awarded to students according to their respective guidelines, which are described in more detail in Financial Assistance at ESF.

The following is a list of the programs: Maurice Alexander Wetland Research Award, Alumni Educational Grants, Alumni Memorial Awards, Warren Bennett Memorial Award, John Berglund Memorial Scholarship, Simeon H. Bornt III Scholarship Award, Nelson Courtlandt Brown Scholarship Fund, Henry H. Buckley Student Aid Award, John Clark Scholarship, Class of '31 Scholarship, William Cross Memorial Scholarship, Edward Czycon Scholarship, Wilford A. Dence Memorial Award, Morris Hirsch Scholarship, Meyer Environmental Chemistry Scholarship Award, Meyer Wood-Plastic Scholarship Award, Onondaga Anglers' Association Scholarship, Portia Farrell Morgan Scholarship, Ranger School Alumni Scholarship, Eugene C. Reichard Scholarship Award, Ray Rizzo Scholarship, Phyllis Roskin Memorial Award, Saratoga Association Scholarship, Lt. Gary Scott Memorial Scholarship, Student Association Grants, Walter Tarbox Memorial Scholarship, John J. View Scholarship, Wildfowlers Association of Central New York Scholarship, Gerald H. Williams Scholarship, and the Phillip Zipf Scholarship.

Syracuse Pulp and Paper Foundation Scholarships

Scholarships from the Syracuse Pulp and Paper Foundation, Incorporated, are awarded to United States citizens who are undergraduate students in paper science and engineering, and have at least a 2.500 grade point average (4.000 = A). The scholarship may amount to the recipient's annual tuition charge. Students entering the program should ask the Office of Financial Aid for a Pulp and Paper Scholarship application form, and reapply each year for the scholarship.

State University Supplemental Tuition Assistance

The College annually awards small grants to a limited number of students with financial need as part of the State University Supplemental Tuition Assistance program.

Employment Opportunities

College Work-Study Program

The College participates in the Federal College Work-Study Program, which provides part-time jobs during the academic year and full-time posi-

tions during the summer to students who need financial assistance to attend the College. Wages for these positions begin at above the minimum wage and increase as duties and responsibilities increase. The current wages are $4.50 per hour during the academic year and $6 per hour during the summer.

Job Locator Service

The College coordinates and maintains an active program of part-time and summer employment opportunities. Interested students should contact the Student Employment Coordinator in the Office of Financial Aid for additional information. The program is open to all ESF students seeking employment.

Loans

Perkins Student Loans

Perkins Student Loans, formerly known as National Direct Student Loans, are available to students with financial need who are enrolled at least half-time. Under the program, $4,500 can be borrowed for two years, $9,000 for four years, and a maximum of $18,000 can be borrowed, including funds for graduate study. A repayment plan, including 5 percent interest, begins nine months after the student leaves college. Deferment and cancellation benefits are available in certain situations. The average loan per student totaled $1,852 in 1990-91.

Stafford Student Loans

The Stafford Student Loan program, formerly Guaranteed Student Loans, is administered by the New York Higher Education Services Corporation for New York State residents.

These loans are available from a bank or other lending agent to students who are registered at least half-time. Undergraduates can borrow an aggregate of $17,250 for their undergraduate studies, while graduate students can borrow an aggregate of $54,750. A repayment plan, including 8 percent interest, begins six months after the student leaves college. An additional 1 percent interest is charged at the time the loan is received. Applications are available at local banks. The average Stafford Student Loan was $3,111 in 1990-91.

Parent Loan for Undergraduate Students

Parents of undergraduate students may borrow from local lending institutions up to $4,000 annually and $20,000 overall at an interest rate of 12 percent with a Parent Loan for Undergraduate Students (PLUS). A repayment plan begins 60 days after receipt of the loan, which cannot exceed the total cost of the student's education. Applications for PLUS loans are available at local lending institutions.

Supplemental Loan to Students

Supplemental Student Loans are available for graduate, or independent undergraduate students who want to borrow more than their Stafford Student Loan limit. Eligible students may borrow up to $4,000 per year until they reach a total of $20,000.

Emergency Loans

The College is able to provide some matriculated students interest-free, short-term loans. These 30-day loans are available through the support of the Alumni Association Short-term Loan Fund, the David B. Schorer Memorial Fund, and the Edward Vail Emergency Fund. For more information, contact the Office of Financial Aid.

Graduate Assistantships and Tuition Scholarships

Assistantships are awarded to students who have demonstrated scholarship and academic promise, and whose education and experience enable them to assist in laboratory instruction and research. The amounts of the assistantships range from $6,800 per academic year to as high as $18,000 for a calendar year. In addition, a tuition scholarship may be awarded. Students who hold an assistantship must be enrolled for full-time study as defined by graduate policies, and be making satisfactory progress toward completing their degree.

Beginning graduate students may apply for assistantships on their application for admission. Continuing graduate students should consult with their major professors.

Academic Policies

Undergraduate Policies

General Requirements

A student seeking a degree must be in matriculated status. All degree requirements must be completed through a combination of formally accepted transfer credits and/or courses taken at ESF and Syracuse University. While a student is matriculated at ESF, all courses taken at ESF and Syracuse University to meet degree requirements must be graded on a scale of "A-F," and the grades will be computed in the grade point average.

Credit Hour Load

To be classified as full-time, a student must register for at least 12 credit hours during a semester. A student may not register for more than 18 credits during a semester unless permission from the student's advisor is obtained.

Attendance

Students are expected to adhere to the attendance policy stated by each course instructor. Instructors may make attendance part of the course requirement.

Course Numbering System

Courses at ESF are numbered according to the following system:

100-499 Undergraduate courses for which no graduate credit may be given.

500-599 Graduate courses designed expressly for areas of specialization in post-baccalaureate programs or in the professional program leading to the bachelor of andscape architecture. Qualified undergraduate students may enroll by permission of the instructor.

600-699 Graduate courses designed expressly for advanced levels of specialization. Undergraduate students with a cumulative grade point average of 3.000 or better may enroll in these courses with an approved petition.

700-999 Advanced graduate level courses for which no undergraduate students may register.

Shared resources courses, designated as 400/500 or 400/600, are designed when the topic coverage of both courses is the same. Separate course syllabuses are developed expressly differentiating the requirements and evaluative criteria between the undergraduate course and the graduate course. No type of crosslisting may be offered unless approved by the ESF Faculty.

Physical Education and R.O.T.C.

Physical Education and R.O.T.C. course credits may be used to satisfy elective requirements with the permission of the student's academic advisor.

Audits

Students may informally audit ESF courses with the permission of the course instructor. No record will be maintained of the informal audit nor will any grade be assigned. No fee is required for informal audits.

Students may formally audit courses with the permission of their academic advisor and the course instructor. They may not be used to satisfy any graduation requirements. Formally audited courses will appear on the students' transcripts and will be graded either "SAU" (satisfactory audit) or "UAU" (unsatisfactory audit). The grade will be assigned based on the criteria for audit established by the course instructor. Registration guidelines for audited courses are the same as for courses taken for credit.

Dropping or Adding Courses

Students may add courses with the approval of both their academic advisor and the course instructor and may drop courses with their advisor's approval and notification to the course instructor via an appropriate drop/add form until the last day for program adjustments as listed in the ESF calendar. Courses dropped during this time will not appear on the student's transcript. Courses that begin after the published add date may be added prior to the start of the course. Courses that last for less than one semester may be dropped no later than half way through the course. In either case, the student must submit a completed add-drop form.

Repeating Courses

Students may repeat any course previously taken either to earn a higher grade or because of a previous failure. However, the credit hours for the course repeated may be counted only once toward meeting graduation requirements. Credit hours carried and grade points earned will be included in the semester and cumulative grade point averages each time the course is completed.

Withdrawal from ESF

Students who withdraw on or before the "drop date" for a semester will have their records marked. "Withdrew on (date)." Courses will appear for that semester with the grade of "W."

Students who withdraw after the "drop date" for a semester, but on or before the last class day before the final examination period, will have either "WP" (withdraw passing) or "WF" (withdraw failing) listed after each uncompleted course. Students who do not withdraw on or before the last class day will have a grade of "A-F," "I," or "I/F" assigned by the instructor for each registered course.

Students who withdraw from ESF and in the future wish to return must apply for readmission. Prior to withdrawal from ESF, students must schedule an interview in the Office of Student Affairs and Educational Services.

Curriculum Requirements

The development and administration of course offerings, prerequisites, sequencing, and program requirements are primarily the responsibility of each program Faculty with the approval of the ESF Faculty.

Students must satisfy the requirements for graduation presented in the catalog in effect as of the date they first matriculate at ESF. Students may graduate under the requirements stated in any catalog issued subsequent to the one in effect the date they matriculate, but they may not use a prior catalog.

Students who change majors are required to submit a completed change of curriculum form approved by representatives of both programs and must complete all the requirements of their new major.

Evaluation

For each course completed, one of the following grades will be awarded:

Grade	Definition	Grade Points
A	Excellent	4.000
A-		3.700
B+		3.300
B	Good	3.000
B-		2.700
C+		2.300
C	Passing	2.000
C-		1.700
D	Minimum Passing	1.000
F	Failure	0.000
I/F	Unresolved Incomplete	0.000

In order to receive a bachelor's degree, a student must complete all courses taken as a matriculated student at ESF with a cumulative grade point average of at least 2.000.

Under conditions defined elsewhere, the following grades may be assigned, none of which yield grade points:

Grade	Definition
W	Withdraw
WP	Withdraw Passing
WF	Withdraw Failing
SAU	Audit (Satisfactory)
UAU	Audit (Unsatisfactory)
I	Incomplete

Grade Point Averages

Semester and cumulative averages are computed by dividing the total grade points earned by the total credit hours completed for all courses graded "A-F."

Incomplete Courses

A temporary grade of "I" may be assigned by an instructor only when the student is passing and has nearly completed the course, but because of circumstances beyond the student's control, the work is not completed. The incomplete grade must be resolved prior to the end of the semester following that in which the incomplete was received. At the request of the student and with a petition approved by the course instructor only, the incomplete may be extended one additional semester. If the incomplete is not resolved by the appropriate deadline, it will be changed to a grade of "I/F."

Academic Honors

President's Honors List

Students who carried 12 or more credits of coursework graded "A-F" and earned a minimum grade point average of 3.000 with no grades of "I" or "F" will be placed on the President's Honor List for that semester.

Graduation Honors

Students will be graduated with the appropriate honor if the following criteria have been met:

A minimum of 30 credits of ESF and Syracuse University courses have been completed as a matriculated, upper-division student.

A cumulative grade point average of: 3.000 - 3.333, *cum laude*; 3.334 - 3.829, *magna cum laude*, 3.830 - 4.000, *summa cum laude*.

Academic Dismissal

Students who earn less than a 2.000 cumulative grade point average shall have their records reviewed by the Faculty Subcommittee on Academic Standards. Based on this review, the Subcommittee shall recommend to the Dean of Instruction and Graduate Studies that each student with less than this minimum cumulative grade point average be either placed on academic probation or dismissed from ESF. The recommendation on probation or dismissal will be based upon an overview of the total academic record and the mathematical possibility for attaining a 2.000 cumulative average by the projected graduation date. The Dean of Instruction and Graduate Studies will take final action and so inform each student in writing.

Each student dismissed will be given the opportunity to appeal that decision based on any extraordinary conditions which may have contributed to the student's unsatisfactory performance. This appeal must be made in writing and submitted to the Office of the Dean of Instruction and Graduate Studies within the stated time limit. Each appeal will be reviewed by the Faculty Subcommittee on Academic Standards which will recommend to the Dean of Instruction and Graduate Studies either to sustain the dismissal or place the student on probation. The Dean of Instruction and Graduate Studies will take final action and so inform each student in writing. There is no appeal beyond this process.

Students who have been dismissed for academic performance may not reapply until at least one semester has elapsed. Courses taken during the dismissal period may not be applied to the student's academic program.

Students dismissed a second time for academic performance may not again be considered for readmission.

Graduation Requirements

Students are responsible for meeting the following requirements for graduation:

1. Matriculated status as an undergraduate student;
2. All course requirements must be satisfied;
3. A minimum cumulative grade point average of 2.000 (4.000=A) for all courses taken as a matriculated student at ESF;
4. At least 24 of the last 30 credits must be registered for through ESF;
5. Consistent with the State Education Department requirements, a total of at east 120 credits from courses accepted as transfer credit by ESF and courses successfully completed while a matriculated student at ESF.

Exceptions to Curriculum and Academic Policy Requirements

Exceptions to academic policies stated in this document and curriculum requirements may be made by the Faculty Subcommittee on Academic Standards which may delegate this authority. Exceptions may not violate standards established by the State University of New York or the State Education Department.

Exceptions must be requested on a petition form which must have a recommendation from the student's advisor and Faculty Chair or his designee. In those cases where an action is requested involving a specific course, the petition must also have a recommendation from the course instructor.

Graduation Rate

Of the transfer students who began their studies in the fall of 1988 at ESF, 83 percent received their degree, or continued in a five-year program, after four semesters of study. For those who began in the fall of 1989, approximately 84 percent received their degree, or are continuing in a five-year program, after four semesters of study. Further information on student retention is available from the Office of the Dean of Instruction and Graduate Studies.

Graduate Academic Policies

Statement of Objectives

The objectives of graduate degree programs at ESF are to educate graduate students to (1) think critically and independently, (2) comprehend the processes of science and effectively apply scientific and professional procedures, (3) attain proficiency in the current level of knowledge in their respective fields, (4) become competent in the requisite technical skills and tools, (5) practice high standards of performance as scientists, educators, and professionals, and (6) exercise ethical conduct in their relationships with colleagues, other professionals, and the public.

Admission

General Requirements

Admission to graduate studies is conditional upon review and acceptance of the applicant's credentials by appropriate Faculty members and upon the recommendation of the appropriate Faculty Chair to the Dean of Instruction and Graduate Studies. Employees of the College who carry faculty status in accordance with SUNY ESF faculty bylaws and are at or above the rank of assistant professor or equivalent, may not be in a matriculated status at the College. Required for admission are at minimum a bachelor's degree from a recognized institution, and generally an academic record showing at least a "B"' average for junior and senior years of the baccalaureate program or for the master's program. Also required are Graduate Record Examination scores and for some degree programs, advanced test scores; supporting letters of recommendation; and a statement of educational and professional goals. The Graduate Record Examination may be waived by a Faculty on an individual basis.

International Students

The College accepts international students in graduate programs if they can satisfy regular admission requirements. In addition, those who do not have an undergraduate or graduate degree from a college or university at which English was the language of instruction, must demonstrate proficiency in the English language through achievement of a score of 550 or higher on the Test of English as a Foreign Language (TOEFL).

Degrees

Master's Degrees

Three master's degrees are offered at ESF: Master of Science, Master of Landscape Architecture, and Master of Forestry degrees. Degree requirements and program alternatives are listed below.

Master of Science (M.S.)
Master of Landscape Architecture (M.L.A.)

The Master of Science degree is an academic degree offered in the following degree programs: forest chemistry, environmental and forest biology, forest resources management, environmental and resource engineering, and environmental science. Minimum requirements for the Master of Science degree are listed under Master's Degree Program Alternatives. The Master of Landscape Architecture degree is a professional degree offered in the landscape architecture degree program. The degree can be attained through all three program alternatives described below, with additional requirements as prescribed under the degree program.

Master's Degree Program Alternatives

Master of Science
and Master of Landscape Architecture

There are three program alternatives for the Master of Science and Master of Landscape Architecture degrees, namely:

1. Thesis or Project and Defense

Under this program alternative, in addition to completion of necessary coursework, students prepare either (1) a research-oriented thesis which investigates a problem that initiates, expands or clarifies scientific knowledge in the field, or (2) an application-oriented project report that applies skills or techniques from the field to address a specific problem. Whichever is chosen, students are required to define an appropriate problem for investigation; review relevant information; develop a study plan; collect, analyze and interpret data; test hypotheses and draw conclusions; and relate the results to scientific theory or body of knowledge in the field.

The minimum credit hour requirement is the successful completion of 30 credits distributed between coursework and thesis or project. The applicable distributions will be determined by individual Faculties to suit the programs, with the understanding that a minimum of 18 credits is awarded for graduate

level coursework, including at least 12 credit hours of coursework taken in residence at ESF, and a minimum of 6 credits is awarded for the thesis. The student's study plan is approved by the major professor, steering committee and Faculty Chair. The student must successfully defend the thesis or project for degree completion. The thesis or project is prepared and bound according to College standards and deposited in Moon Memorial Library.

2. Academic or Professional Experience and Master's Comprehensive Examination

Under this program alternative, in addition to completion of necessary coursework, students participate in an academic or professional experience which enriches and complements the coursework of their study plan. Whatever the format of the program, its objectives, organization, procedures, and manner of documentation must be submitted in writing and must be approved by the student's major professor, steering committee, and Faculty Chair before the experience is begun.

The successful completion of a minimum of 24 credits of graduate level coursework is required for this program alternative, including at least 18 credit hours of coursework taken in residence. Additionally, a minimum of 6 credits (course number 898) will be awarded for successful completion of the academic or professional experience, for a total minimum of 30 credits for this program alternative. The student must prepare a report satisfactory to the steering committee, and the student must pass a comprehensive examination covering the student's fields of study and academic or professional experience. The student's report on the academic or professional experience, prepared and bound according to College standards, will be maintained by the individual Faculty.

3. Coursework and Master's Comprehensive Examination

The successful completion of a minimum of 42 credits of graduate level coursework is required for this program alternative, including at least 36 credit hours taken in residence. The student's study plan is approved by the Major Professor, steering committee and Faculty Chair. Upon completion of the coursework, the student must pass a comprehensive examination covering the student's fields of study.

Master of Forestry

The Master of Forestry degree is a professional degree offered in the forest management and operations degree program. The degree is granted upon successful completion of 37 credit hours of graduate level coursework, as prescribed in the degree program. At the end of the program, the student must successfully complete a written comprehensive examination testing the student's knowledge of the material covered and the student's ability to analyze appropriate problems. No thesis or other product is required.

Doctor of Philosophy Degree

General Requirements

The Doctor of Philosophy degree is an academic degree offered in the following degree programs: forest chemistry, environmental and forest biology, forest resources management, environmental and resource engineering, and environmental science. The Doctor of Philosophy (Ph.D.) degree requires a minimum of 60 graduate credits, of which 30 to 48 credits are for coursework and 12 to 30 credits are awarded for thesis. Individual Faculties will determine the applicable credit hour requirements within these ranges to reflect individual program requirements and emphases. The graduate credits earned for a master's degree that are applicable to a student's doctoral study plan are determined on an individual basis by the steering committee. The student must pass the doctoral candidacy examination covering selected fields of study at least one year prior to thesis defense, and successfully defend the thesis. The thesis must be prepared according to College standards and will be deposited in Moon Memorial Library.

Tool Requirements

Doctoral students must demonstrate competence in at least one research tool as a requirement for graduation. Such tools include statistics, computer science, or the ability to translate technical articles in a language other than English commonly used in science. Tool requirements and standards for each doctorate program will be determined by the corresponding program Faculty.

Student Advising and Study Plan

Major Professor: Appointment and Responsibilities

The student's major professor is appointed by the Dean of Instruction and Graduate Studies, upon the recommendation of the Faculty Chair. A major professor should be appointed upon the student's matriculation into a graduate program. For the gradu-

ate student accepted into a graduate program but lacking a major professor, a temporary advisor will be appointed by the Faculty Chair. However, every effort should be made to expedite appointment of a major professor as soon as possible.

It is the duty of the major professor to fulfill a primary role as the student's mentor. Aided by other members of the steering committee, the major professor guides the student in the development and implementation of the study plan, including course selection, research planning, choice of the professional experience, facilitation of the examination schedule, and reviews of thesis or project report drafts, including a complete review of the thesis or project report before the final copy is presented for defense.

Steering Committee: Appointment and Duties

The steering committee for all master's and doctoral students is composed of the major professor and at least two faculty members or other qualified persons. Other qualified persons include faculty at other institutions, or other recognized professionals.

The student's steering committee is appointed by the Dean of Instruction and Graduate Studies, upon the recommendation of the Faculty Chair. The steering committee should be appointed within the first semester. For all students, the steering committee must be established and must have met by the end of the third semester of graduate study.

The steering committee assists the student in the development of the study plan, including the development of the student's research, project or academic/professional experience. The steering committee guides the development of the thesis or project report, including a review of the thesis or project report before the final copy is presented for defense.

Student's Study Plan

The student's study plan includes an individualized sequence of courses and a plan for research or project or academic/professional experience. The study plan, developed by the student with the advice and approval of the major professor and other members of the steering committee, must be submitted to the Faculty Chair for approval and then forwarded to the Dean of Instruction and Graduate Studies at least by the end of the third semester. The study plan can be changed during the course of each student's studies. Changes must be approved by the major professor, Faculty Chair, and the Dean of Instruction and Graduate Studies.

Examinations

Master's Comprehensive Examination

The objectives of this examination are to determine the student's breadth and depth of knowledge in the chosen field of study, and to assess the student's ability to use that knowledge creatively and intelligently. Upon the recommendation of the appropriate Faculty Chair, the Dean of Instruction and Graduate Studies appoints the master's comprehensive examination committee consisting of the student's Major Professor, steering committee and at least one other faculty member from an appropriate area. Additionally, the Dean of Instruction and Graduate Studies appoints a committee chair who is not from the Faculty of the student's degree program. The examination has both oral and written components, with the exception that the Master of Forestry degree has a written component only.

The role of the examination committee chair is to manage the examination, ensure its integrity, and represent the interests of the faculty and students. Any member of the faculty may be an observer at the oral component of any comprehensive examination. The student examinee may invite a silent student observer to attend the oral examination.

Written Examination: The chair of the examination committee receives written questions or problems addressing the objectives of this examination. The committee chair reviews the questions and may convene the committee to discuss the examination and ensure that questions are appropriate and fair.

The major professor administers the written examination. Usually, one-half day is allocated to questions submitted by each examiner. Upon completion by the student, the examination questions are reviewed and graded by the committee members who prepared them. Then, the entire examination is reviewed by the examining committee.

Oral Examination: Where both oral and written components are required, the oral examination follows the written examination. This examination usually lasts two hours; however, the duration may be longer, if required. The questions may address written answers or other areas appropriate to the objectives of the examination. At the conclusion of the examination period, the student examinee and observers are excused from the room and the examining committee determines whether the student has passed the examination. Unanimous agreement is required to pass the student. If less than unanimous agreement is reached, the student is considered to have failed the comprehensive examination. The student can re-

quest a second examination. A student is considered to have passed the second examination if no more than one negative vote is cast. A student who has failed the second examination is terminated from the graduate program.

Doctoral Preliminary Examination

The requirement for this examination is determined by individual Faculties. The purpose of this examination is to assess the entering student's basic knowledge in the chosen field of study. The results of this examination may be used to determine the student's suitability for the doctoral program and as a guide in selecting coursework and developing a program of study.

Doctoral Candidacy Examination

The objectives of this examination are to determine the student's breadth and depth of knowledge in the chosen field of study and to assess the student's understanding of the scientific process. The doctoral candidacy examination is taken when the majority of coursework is completed. This examination must be taken at least one year prior to the thesis defense.

Upon the recommendation of the appropriate Faculty Chair, the Dean of Instruction and Graduate Studies appoints the doctoral candidacy examination committee consisting of the student's major professor, the student's steering committee, and an additional faculty member from an appropriate area. Additionally, the Dean of Instruction and Graduate Studies appoints a committee chair who is not from the Faculty of the student's degree program. The examination must have both written and oral components.

The role of the examination committee chair is to manage the examination, ensure its integrity, and represent the interests of the faculty and student. Any member of the faculty may be an observer. The student examinee may invite a silent student observer to attend the oral examination.

Written Examination: There are two alternative forms for the written component, as follows:

Form 1: The chair of the examining committee receives written questions or problems addressing the objectives of this examination. The committee chair reviews the questions and may convene the committee to discuss the examination and ensure that questions are appropriate and fair.

The major professor administers the written examination. Usually, one-half day is allocated to questions submitted by each examiner. Upon completion by the student, the examination questions are reviewed and graded by the committee members who prepared them. Then, the entire examination is reviewed by the committee.

Form 2: The student prepares a written report on a topic or problem assigned by the examining committee. The topic or problem must meet the objectives of this examination and its content cannot be directly related to the student's thesis research. The student has approximately one month to develop a thorough understanding of the assigned topic and prepare a written report. The report is reviewed by committee members and committee chair.

Oral Examination: Following the written examination under Form 1, or completion of the report under Form 2, the committee meets with the student for an oral examination usually lasting two hours. However, the duration can be longer if required. The questions may address the report or other areas appropriate to the objectives of the examination, including subject matter in allied fields. At the conclusion of the examination period, the student examinee and observers are excused from the room and the examination committee determines whether the student has passed the examination. Unanimous agreement is required to pass the student. If less than unanimous agreement is reached, the student is considered to have failed the first doctoral candidacy examination. The student can request a second examination. A student is considered to have passed the second examination if there is no more than one negative vote. A student who has failed the second examination is terminated from the graduate program.

Thesis or Project Defense Examination

Thesis: At the conclusion of the study and research program, each doctoral candidate or master's candidate completing a thesis under Program Alternative 1 must successfully defend the thesis. The objectives of the thesis defense examination are (1) to probe the validity and significance of the data and information presented in the thesis, (2) to assess the student as a critical thinker and data analyst, (3) to evaluate the student's scientific creativity, including the student's ability to relate research results to scientific theory within the chosen field, and (4) to present the results effectively in writing.

Project: Each master's candidate completing a project under Program Alternative 1 must successfully defend the project. The objectives of the project defense are (1) to determine how well the student has applied technical skills in problem solving, (2) to assess the student's creativity and innovation in

developing the project, and (3) to evaluate the significance of the student's work in the context of professional theory and practice.

Upon the recommendation of the appropriate Faculty Chair, the Dean of Instruction and Graduate Studies appoints the thesis or project defense examination committee. It consists of members of the steering committee, and at least one additional faculty member for the master's degree examination and two additional faculty members or other qualified persons for the doctoral degree examination. Additionally, the Dean of Instruction and Graduate Studies appoints a committee chair who is not from the student's degree program.

This oral examination covers principally the material in the thesis or project, as well as literature and information relating to the thesis or project.

The role of the examination committee chair is to manage the thesis or project defense, ensure its integrity and represent the interests of the faculty and student. Any member of the faculty may be an observer. The student examinee may invite a silent student observer to attend the examination. The defense examination usually lasts two hours, although this time period may be extended as required. At the completion of the examination, the candidate and observers are excused from the room and the examination committee determines whether the candidate has successfully defended the thesis. Unanimous agreement is required to pass the student. If less than unanimous agreement is reached, the student is considered to have failed the first doctoral defense examination. A student who fails the first defense may request a second defense. At the second defense, the student has passed the defense if there is no more than one negative vote. A student who has failed the second defense is terminated from the graduate program.

Evaluation

Grades

For each course completed, one of the following grades will be awarded:

Grade	Definition	Grade Points
A	Excellent	4.000
A-		3.700
B+		3.300
B	Satisfactory	3.000
B-		2.700
C+		2.300
C		2.000
C-	Minimum Passing	1.700
F	Failure	0.000
I/F, I/U	Unresolved Incomplete	0.000

Under conditions defined elsewhere, the following grades may be assigned, none of which yield grade points:

Grade	Definition
W	Withdraw
WP	Withdraw Passing
WF	Withdraw Failing
S	Satisfactory
U	Unsatisfactory
SAU	Audit (Satisfactory)
UAU	Audit (Unsatisfactory)
I	Incomplete

Grade Point Average

Semester and cumulative averages are based on graduate level courses only and are computed by dividing the grade points earned by the credit hours completed in all courses graded "A-F."

Incomplete Courses

A temporary grade of "I" may be assigned by an instructor only when the student is passing and has nearly completed the course, but because of circumstances beyond the student's control, the work is

not completed. The incomplete grade must be resolved prior to the end of the semester following that in which the incomplete is received. At the request of the instructor, under extraordinary conditions, the incomplete may be extended for one additional semester. If the incomplete is not resolved by the appropriate deadline, it will be changed to a grade of "I/F" or "I/U."

Academic Performance, Credit Hour Load, Transfer Credit, and Time Limits

Academic Performance

All graduate students are required to maintain at least a 3.000 cumulative grade point average (4.000 = "A") for graduate level courses. Students who do not maintain this average, or who receive two or more grades of Unsatisfactory ("U") for work on the thesis or project, will be placed on probation or dismissed from ESF by the Dean of Instruction and Graduate Studies upon the recommendation of the College Subcommittee on Academic Standards.

Credit Hour Load

To meet academic requirements, graduate students must be registered for at least one credit each semester, excluding summers, from the first semester of matriculation until all degree requirements have been completed. Students are required to register for at least one credit in the summer if they will complete all requirements during that time. There is no full-time credit hour load to meet academic requirements.

Graduate students who hold an assistantship and/or a tuition scholarship must be in a full time status each semester while holding such an award. Usually registration for nine credits equates to full time status for a student holding an assistantship.

Graduate students not holding an assistantship are considered full-time if they are registered for at least 12 credits each semester.

Master's students who have met all academic requirements except for their thesis defense or an examination and all doctoral candidates (i.e., those who have successfully completed their doctoral candidacy examination) will be considered full time if registered for at least one credit of thesis research, professional experience, or independent study and have their major professor verify in writing they are working full time on the completion of degree requirements.

For the summer, graduate students will be considered full time if registered for at least one credit of thesis research, professional experience, or independent study and have their major professor verify in writing they are working full time on the completion of degree requirements.

Transfer Credit

Up to six credits of graduate coursework in which a minimum grade of B was earned from an accredited institution and not used to complete another degree may be accepted towards completion of a master's or doctoral degree as approved by the steering committee.

Time Limits

Graduate students must complete all requirements for the master's degree within three years of the first date of matriculation. For the doctoral degree, students must complete all degree requirements within three years of passing the doctoral candidacy examination, or they will be required to retake the candidacy examination.

Procedures for Review, Grievance, Dismissal, Appeal, and Reapplication

Procedures for review, grievance, dismissal, appeal and reapplication, as developed by the ESF faculty within SUNY guidelines, will be publicized in the Graduate Student Handbook.

Area of Study

The general area of study for each master's or doctorate student is implied by the title of the program in which the degree is awarded. Areas of study may be established within degree programs by individual Faculties that further define the student's area of specialization. The student's area of study is listed on the student's transcript if identified on the study plan.

Additionally, each Faculty may offer minors identifying ancillary areas of study that may be appropriate for the degree program. A minor is equivalent to 12 or more graduate credits earned in the minor area. Courses in a minor area must be taken outside of the student's area of study. A minor is identified on the student's transcript. A minor professor must be appointed to the student's steering committee for each minor elected, in addition to the minimum complement of steering committee members. Each minor professor can replace an additional examiner.

Competency in Communication Skills and Graduate Seminars

Communication Skills

All students entering graduate programs at ESF are expected to be proficient in communication skills, including technical writing and library skills. Students are required to have completed at least one course in technical writing and one course in library usage, either as an undergraduate or as a graduate student. Credits for such courses taken during the graduate program are not counted towards degree requirements. Alternatively, graduate students can meet the requirement by demonstrating the equivalent in experience in writing and library skills, as determined by the steering committee.

Seminars

Participation in seminars, including the preparation and presentation of technical material, is vital to the student's graduate education. All graduate students at ESF are required to participate in graduate seminars, as follows:

Topic Seminar: Each graduate student is expected to participate in topic seminars, including presentations, as determined by the individual Faculty. This requirement can be fulfilled, with appropriate approval, by seminars offered at Syracuse University or the SUNY Health Science Center at Syracuse.

Capstone Seminar: Students completing the master's degree under Program Alternative 1 or 2, or the Ph.D. degree, are required to present a "capstone seminar" on their thesis or project research, academic, or professional experience. Masters' students under Program Alternative 3 are required to present a capstone seminar on a topic chosen in consultation with the Major Professor and steering committee. The purpose of the capstone seminar is to provide an opportunity for the graduate student to present technical information to a critical body of professionals and peers. This seminar will be presented prior to the thesis defense or comprehensive examination and should be attended by the student's steering committee. Each seminar is open to the College community and will be announced collegewide to encourage attendance by students and faculty.

Course Numbering System

Courses at ESF are numbered according to the following system:

100-499 Undergraduate courses for which no graduate credit may be given.

500-599 Graduate courses designed expressly for areas of specialization in post-baccalaureate programs or in the professional program leading to the bachelor of landscape architecture. Qualified undergraduate students may enroll by permission of the instructor.

600-699 Graduate courses designed expressly for advanced levels of specialization. Undergraduate students with a cumulative grade point average of 3.000 or better may enroll in these courses with an approved petition.

700-999 Advanced graduate level courses for which no undergraduate students may register.

Shared resources courses, designated as 400/500 or 400/600, are designed when the topic coverage of both courses is the same. Separate course syllabuses are developed expressly differentiating the requirements and evaluative criteria between the undergraduate course and the graduate course. No type of crosslisting may be offered unless approved by the ESF Faculty.

Standards for Theses, Projects, and Professional Experience Reports

Collegewide standards for theses, projects, and professional experience reports are developed and specified by the Moon Memorial Library Faculty in consultation with the various Faculties and are available in the Office of the Dean of Instruction and Graduate Studies.

Statement of "Good Academic Standing"

The term "in good academic standing" means that a student is eligible or has been allowed to register for and undertake academic coursework at the College for the semester in question. In some instances the College may define a student as being "on academic probation." The mechanism of academic probation, including any accompanying constraints upon a student's activities, is intended merely as an educational device designed to encourage greater effort on the part of students who are having difficulty in meeting certain academic standards. Placement on

academic probation may precede denial of the right to register for academic coursework if certain conditions are not met, but a student on academic probation is considered to be in good academic standing. Any question concerning whether or not an individual student is in good academic standing will be determined by the Dean of Instruction and Graduate Study.

Religious Beliefs Law

Students unable, because of religious beliefs, to attend classes on certain days are guided by Section 224a of the New York State Education Law which is as follows:

1. No person shall be expelled from or be refused admission as a student to an institution of higher education for the reason that he is unable, because of his religious beliefs, to attend classes or to participate in any examination, study or work requirements on a particular day or days.
2. Any student in an institution of higher education who is unable, because of his religious beliefs, to attend classes on a particular day or days shall, because of such absence on the particular day or days, be excused from any examination or any study or work requirements.
3. It shall be the responsibility of the faculty and of the administrative officials of each institution of higher education to make available to each student who is absent from school, because of his religious beliefs, an equivalent opportunity to make up any examination, study or work requirements which he may have missed because of such absence on any particular day or days. No fees of any kind shall be charged by the institution for making available to the said student such equivalent opportunity.
4. If classes, examinations, study or work requirements are held on Friday after four o'clock post meridian or on Saturday, similar or makeup classes, examinations, study or work requirements shall be made available on other days, where it is possible and practicable to do so. No special fees shall be charged to the student for these classes, examinations, study or work requirements held on other days.
5. In effectuating the provisions of this section, it shall be the duty of the faculty and of the administrative officials of each institution of higher education to exercise the fullest measure of good faith. No adverse or prejudicial effects shall result to any student because of his availing himself of the provisions of this section.
6. Any student, who is aggrieved by the alleged failure of any faculty or administrative officials to comply in good faith with the provisions of this section, shall be entitled to maintain an action or proceeding in the supreme court of the county in which such institution of higher education is located for the enforcement of his rights under this section.

Student Life

Housing

College students may seek housing with Syracuse University Residence Services, the residence halls at the State University of New York Health Science Center, or one of the many off-campus options. The College of Environmental Science and Forestry does not operate its own residence facilities or food service.

Unless they commute from home, freshmen are expected to live in Syracuse University residence halls. Sadler and Lawrinson, which are adjacent to the College campus, are designated as the "ESF cluster." Sophomores are also expected to live in university housing. A maximum of 50 upperclass students from ESF may also choose to live in SUNY Health Science Center residence halls.

Syracuse University housing is within walking distance of the ESF campus, but students may ride free shuttle-buses or city buses between campus and their residence. Students have a choice of living centers, which includes large residence halls, apartment houses, fraternity and sorority houses, or cooperative units. Freshmen and sophomores typically are assigned to Sadler or Lawrinson on the main campus, while upperclassmen may opt for South Campus apartments. Student resident advisors live on each floor or in each unit of residence halls, and are available for counseling, advisement, and referral services. Contracts for room and board made with Syracuse University cover a full academic year — both fall and spring semesters — and are not normally renegotiable during that time period.

Syracuse University also has housing for married students and their families available in the South Campus area.

For more information about costs and availability, contact Residence Services, 202 Steele Hall, Syracuse University, Syracuse, New York 13244, (315) 443-2721.

Housing at the SUNY Health Science Center is also within easy walking distance of the ESF campus. The accommodations are fully furnished, and include standard residence hall rooms, studios, and one-bedroom apartments. For more information, contact Residence Life, 175 Elizabeth Blackwell Street, SUNY Health Science Center at Syracuse, Syracuse, New York 13210, (315) 464-5106.

Students who prefer to find their own housing can get a free list of area apartments from Alternative Action Services (ALTERACTS), (315) 443-5188, which is a student-run organization located in the Schine Student Center at Syracuse University.

Child Care

Onondaga County offers a variety of options for child care. These include 65 licensed day care centers, 62 programs for school age children, 70 nursery and preschool programs, and about 200 legally operated family day care homes. The Onondaga County Child Care Council offers a free referral service. For more information, telephone (315) 472-6919.

In addition, two of our neighboring educational institutions have on-site child care facilities. Syracuse University Day Care Center (443-4481) can accommodate 60 children from 2 months to 6 years of age. The Health Science Center Child Care Center (464-5540) will be able to accommodate 60 children from 6 weeks to 6 years of age once their expansion project is completed. Both centers welcome the children of ESF students on a space available basis.

Food Services

Syracuse University offers different meal plans to help meet the various needs and interests of individual students. Students living in residence halls without full kitchen facilities are required to subscribe to a meal plan, while students living in university apartments, co-ops, fraternities and sororities, or off-campus, may purchase a meal plan if they so desire.

The College does not provide food services. However, The Gallery, located in the basement of Marshall Hall, offers snacks and light meals from 7 a.m. to 2:30 p.m. weekdays during the academic year.

Health and Medical Facilities

Students may consult a physician for medical care or health advice at the Syracuse University Health Service, 111 Waverly Avenue, (315) 443-2666. Full-time students are entitled to unlimited visits to the out-patient clinic and 10 days of ordinary medical care and confinement in the infirmary per college year. Infirmary stays totaling more than 10 days will be charged at prevailing infirmary rates. There are separate charges for all X-rays, medications, and some laboratory tests.

Student accident or health insurance plans not

only supplement the usual infirmary privileges, but can provide health protection during the summer months when students are not under the care of the Health Service. Married students with dependents who are not covered by Health Service privileges are strongly urged to purchase health insurance made available to students through ALTERACTS.

All international students, as well as faculty and students planning to study abroad, are required to carry health and accident insurance supplied by the State University of New York. Further details about this policy are available from SU's International Student Office, 310 Walnut Place, (315) 443-2457, or from the ESF Office of Student Affairs and Educational Services.

Services

College Career and Counseling Services

The Office of Career and Counseling Services is available to students who seek the advice of an experienced counselor, and should be contacted whenever personal questions or problems arise. Problems requiring further assistance may be referred to the appropriate office at Syracuse University, or to specialized agencies in Syracuse.

The Career and Counseling Services staff helps students adjust to life at ESF, successfully graduate from the College, and make the transition into the work force. Through various presentations, counseling sessions, group activities and workshops, students can develop their decision-making, studying, and time-management skills. Other programs explore the adjustments students must make when entering college or transferring between institutions.

The office also provides career counseling to meet the individual needs of students at various stages of their education and/or employment search through a variety of materials and presentations. The career services offered include skills development workshops, job lists, on-campus recruiting visits, company literature, career newsletters, and reference information. A bi-weekly job list is provided to new graduates for six months at no cost, and to alumni by subscription.

The office also conducts an annual Placement Survey to monitor the success and progress of ESF graduates. The reports are available at the Office of Career and Counseling Services.

Syracuse University offices providing additional assistance with a broad range of concerns or difficulties include the Office of Student Assistance, the Counseling Center, the Goldberg Marriage and Family Therapy Center, the Hendricks Chapel staff and denominational chaplains, the Psychological Services Center, the Office of International Services, and the Campus Mediation Center. Students who want an analysis of their aptitudes, abilities, and interests may seek assistance at the university's Testing and Evaluation Service Center.

Academic Support

Academic support services for learning disabled students, as well as students requiring tutorial and remedial assistance, are available through the Syracuse University Academic Support Center. Students with identified learning disabilities should contact the ESF Office of Student Affairs and Educational Services so that appropriate services can be provided.

Services for Disabled Students

Students who experience temporary disabilities or incapacitating injuries that require special transportation or classroom assistance should contact the Office of Student Affairs and Educational Services.

The office staff provides specialized support services and helps more permanently disabled students obtain maximum academic, social, and cultural benefits within the College community. The College is also prepared to respond to disabled students' needs for personal and career counseling, and job placement assistance. For further information contact the Office of Student Affairs and Educational Services, or the College's 504 Coordinator in the Office of Administration.

The Gebbie Speech and Hearing Clinics at Syracuse University provide free remedial assistance to all regularly enrolled students who may have hearing, speech, and/or voice disabilities. To reach Syracuse University Disabled Services/Office of Student Assistance, 304 University Avenue, telephone (315) 443-4357, or 443-5019 for a Telecommunication Device for the Deaf (TDD).

The College maintains liaison relationships with local and state rehabilitation agencies, including the Office of Vocational Rehabilitation and the Commission for the Visually Handicapped. Students should contact the proper agency for specific information about eligibility.

Public Safety

The Public Safety Department at ESF operates 24 hours per day, seven days per week. There is also a network of emergency telephones and intercoms throughout the campus.

Anything of a dangerous or suspicious nature should be reported to the Public Safety Department office in the basement of Bray Hall, (315) 470-6666. The department also handles questions about on-campus parking and off-hour entrance to campus buildings.

Extracurricular Activities

Students at the College can choose from extracurricular activities at both ESF and Syracuse University, as well as within the City of Syracuse, Onondaga County, and the surrounding area.

At ESF

The Undergraduate Student Association (USA) and the Graduate Student Association (GSA) are the official representative bodies on campus governing student organizations. Both undergraduate and graduate students elect representatives from each Faculty to the associations, which manage the affairs and respond to the concerns of their constituents.

The two organizations sponsor a variety of events funded by student activity fees. The events include the All-College Welcome Back Picnic held the first weekend of the fall semester; the Fall Barbecue, a day of informal team competition and outdoor fun held as part of Parent/Family Weekend; and the Spring Awards Banquet, where students, faculty, and staff are recognized for their contributions to the College community. The associations also host several graduate and all-campus "TGIFs" each semester.

The GSA produced the Graduate Student Handbook in 1991 to assist new graduate colleagues in becoming acclimated to the College. The organization also sponsors an annual professional lecture series, and several social events enjoyed by students, staff, and faculty.

Several other campus organizations offer students opportunities to broaden their knowledge, gain experience and leadership skills, and meet other students with similar interests. These groups include the Bob Marshall Club, an organization of students concerned about the future of the Adirondack Mountains; the Forestry Club, sponsor of the intercollegiate Woodsmen's Team; Forest Engineers Club; Mollet Club, an organization of landscape architecture students; Papyrus Club; and the Recycling Club.

Other groups include the: honor society *Alpha Xi Sigma*, which sponsors service activities and such campuswide events as College Bowl; *Alpha Phi Omega*, a service and social fraternity; and *Kappa Phi Delta*, an ESF-affiliated social-professional fraternity located in Syracuse University's "Greek" neighborhood; *Gamma Delta Theta*, founded in 1991 as ESF's first sorority; Chinese Student and Scholar Association; and the Baobab Society, representing the interests and concerns of under-represented student populations at the College.

There are also student chapters of The Wildlife Society, the Society of American Foresters, the American Chemical Society, the American Fisheries Society, the American Society of Landscape Architects, the Associated General Contractors, the Technical Association of Pulp and Paper Industries, the Association for Women in Science, and the American Water Resources Association.

The school's two major student publications are the Knothole, a weekly newspaper, and the Empire Forester, an annual yearbook which has won several awards.

For more information about extracurricular activities contact the Office of Activities and Organizations.

At Syracuse University

Students at the College enjoy the same privileges as Syracuse University students. They may participate in student government or join any of the scores of Syracuse University student groups, which include a wide variety of clubs, the International Student Association, religious and military organizations, and professional and honor societies.

College students may also perform with the Sour Sitrus Society "pep" band, Hendricks Chapel Chorus, Black Celestial Chorale Ensemble, and other performance/arts organizations.

The Archbold and Flanagan gymnasiums are the center of athletics and physical education at Syracuse University, and are adjacent to the ESF campus. Additional indoor facilities are available at Manley Field House and the Carrier Dome, which is the site of Syracuse University's home football, basketball, and lacrosse games. The Women's Building offers instructional, social, and recreational facilities around the corner from the College quad. Facilities on South Campus include a lodge, 22 tennis courts, and a Nautilus exercise room in the new Goldstein Student Center.

Although students at the College can take part in Syracuse University club and intramural sports, the university does not allow ESF students to participate on its Division I intercollegiate teams due to National Collegiate Athletic Association guidelines.

ROTC Opportunities

Many students attending the College are eligible to participate in the Army or Air Force ROTC Program at Syracuse University.

The Reserve Officer Training Corps programs consist of both two- and four-year programs. Students attending the College for two years can gain admission to either the Army or Air Force program through participation in summer training. Both four- and six-week camps and on-campus programs are available to suit the individual needs of students. The ROTC programs offer academic instruction, alternate and supplementary career opportunities, leadership experience, and financial aid.

For more information contact Air Force ROTC, 202 Archbold Gymnasium, (315) 443-2461, and/or Army ROTC, 220 Archbold Gymnasium, (315) 443-2462.

Alumni Association

The Alumni Office serves as the liaison between the College, the Alumni Association Board of Directors, and ESF's more than 13,000 alumni. The association supports educational programs through scholarships, publishes a quarterly newsletter, and represents concerns of ESF graduates.

Student Rules and Regulations

The complete listing of guidelines for all students attending the College is found in the ESF Code of Student Conduct, which is distributed annually. The guidelines pertain to all students, and it is each student's responsibility to be familiar with the regulations and to abide by them.

Syracuse

The College of Environmental Science and Forestry is adjacent to Syracuse University on one of several hills that overlook downtown Syracuse and nearby Onondaga Lake. The metropolitan area, home to more than 650,000 people, and the surrounding countryside offer a variety of cultural, educational, and recreational opportunities.

The city has several fine museums, including the Everson Museum of Art with its outstanding collection of works by local, national, and international artists. Syracuse Stage is known for its professional theater productions, while the Syracuse Symphony Orchestra is one of the nation's finest, and the downtown Civic Center features performing artists from around the world. The area features several colleges and universities. The State University of New York Health Science Center at Syracuse, Le Moyne College, and Onondaga County Community College join ESF and Syracuse University in the city, while Cazenovia College is nestled in a nearby suburb. There are many other institutions of higher education within a short drive, including Colgate College, Cornell University, Hamilton College, Ithaca College, SUNY-Cortland, SUNY-Oswego, and Utica College.

There are eight parks in the city, and numerous county and state parks, including Beaver Lake Nature Center and Montezuma National Wildlife Refuge, are within a short distance. The Adirondacks, Lake Ontario, the Finger Lakes, downhill and cross-country skiing facilities, and golf courses are also within easy driving distance, and make Central New York a haven for recreation and nature lovers.

Once home of the salt industry, the "Salt City" is now a metropolitan area of diversified industry and commerce. The area is a leader in the manufacture of air conditioning equipment, automotive parts, china, pharmaceuticals, lighting equipment, and medical diagnostic equipment.

Syracuse is called the Crossroads of New York State, because it is situated at the intersection of two major highways: the 500-mile east-west New York State Thruway (Interstate 90) and the north-south Penn-Can Highway (Interstate 81). The highways cut the driving time to New York City, Boston, Philadelphia, Toronto, or Montreal, to approximately five hours, while Buffalo and Albany are less than three hours away.

The city is also served by the modern Hancock International Airport, Amtrak, and major bus lines, which makes it a convenient home for students and faculty alike.

The Campuses

The College operates a multiple campus system with regional campuses and field stations located in Syracuse, Tully, Wanakena, Warrensburg, Cranberry Lake, Newcomb, and Clayton. This system is composed of about 1 million square feet of facilities in 186 buildings on 25,000 acres of land.

The Syracuse Campus

The main campus in Syracuse lies on 12 acres adjacent to Syracuse University in an area that traditionally has been known as "The Hill." The principal instructional programs at the bachelor's, master's, and doctoral degree levels are on the Syracuse campus. In addition, the main campus houses important research organizations such as the Empire State Paper Research Institute, the Polymer Research Institute, a cooperative research unit of the U.S. Forest Service, and the Ultrastructure Center.

A vast array of programs are housed in the five main academic buildings: Baker Laboratory, and Walters, Bray, Marshall, and Illick halls. The main campus is also home to Moon Library.

Moon Library

The F. Franklin Moon Library and Learning Resources Center contains more than 106,000 cataloged items, 1,846 serials and abstracts, and receives 1,084 journals. The collection constitutes a specialized information source for the forestry, environmental science, and landscape architecture programs of the College. The collection has concentrations in such areas as botany and plant pathology, biochemistry, chemical ecology, forest chemistry, polymer chemistry, economics, entomology, environmental studies, landscape architecture, environmental design, management, paper science and engineering, photogrammetry, silviculture, soil science, water resources, world forestry, wildlife biology, wood products engineering, and zoology.

The Syracuse University libraries, including the Science and Technology Library immediately adjacent to the ESF campus, and the libraries at the SUNY Health Science Center at Syracuse are within walking distance of ESF. Students at the College are encouraged to refer to those collections if what they need is not in Moon Library.

Other collections located throughout New York State and the United States are readily accessible through inter-library loan. All Syracuse University collections may be searched by using an on-line public access catalog located in Moon Library.

The library building opened in 1968, and can seat 400 people. The main reading areas are located on the upper level adjacent to the open stacks, and are divided by the library catalog and reference service area. The library contains a current periodical room, a bibliographic center containing indexes and abstracts, individual study carrels, and library faculty offices. The Hoverter Archives and special collections, conference room, and computer terminal room are located on the lower level.

The archives contains historical items relevant to the College and forestry development in New York State. The special collections area of the archives includes rare, scarce, and valuable books and folios, as well as the Fletcher Steele collection on landscape architecture and the Thomas Cook collection on papermaking.

Public services provided by the library faculty and staff include a credit course in library research, orientation, class lectures, study guides, user aids, and reference desk services.

Moon Library is a member of the SUNY OCLC network for cataloging and interlibrary loans.

Academic Computing Services

The College provides academic computing services in several ways and at several locations. Public clusters of microcomputers are maintained as combinations of open-shop/classroom facilities for general collegewide use. One of the clusters contains 20 Macintosh SE/30s, another houses 15 Macintosh SEs, and a third has 15 IBM PS/2-55SXs networked together for high-level local use of both simple and sophisticated software, and for communication to external hosts as needed.

Another public cluster contains a total of 16 VDT and four KSR terminals connected at 9600 bps to a network of mainframe computers at Syracuse University. Other clusters contain microcomputers for specialized uses such as graphics and geographic information systems. Semipublic clusters of microcomputers and terminals are also provided in each of the academic buildings on the main campus, and at some of the field campuses.

The host systems on the Syracuse University Academic Computing Service (SUACS) network are

accessible at ESF, and consist of an IBM 3090/150 and a mixture of DEC VAX configurations. Using SUACS as a hub, ESF has access to external networks such as NYSERNET, BITNET, and FASTNET.

Specialized Facilities

Specialized facilities on the Syracuse campus include electron microscopes, plant growth chambers, air-conditioned greenhouses, a bio-acoustical laboratory, a 1,000-curie cobalt-60 radiation source, radioisotope laboratory, computing center, and specialized instrumentation, including a new 300 MHz nuclear magnetic resonance spectrometer with both liquids and solids capability, electron spin resonance spectrometer, gas chromotography, mass spectrometer, ultracentrifuge, and X-ray and infrared spectrophotometer.

The paper science and engineering laboratory features a semicommercial paper mill with accessory equipment. The wood products engineering department has a complete strength-of-materials laboratory as well as a pilot-scale plywood laboratory and a machining laboratory.

Greenhouses and forest insectary are used to produce plant and insect material for classroom and laboratory instruction. Extensive collections are available for study, including wood samples from all over the world, botanical materials, insects, birds, mammals, and fishes.

Instructional Services

The Instructional Services unit of the Learning Resources Center directly supports the program areas of the College through instructional development and application of media materials for the classroom, for the presentation of research findings, and for public service endeavors.

The instructional development services include television programming, slide, tape, and motion picture production, and photographic services. Other services include engineering, audio-visual equipment distribution, and maintenance and support functions. The instructional services staff also participates directly in instructional programs at both the undergraduate and graduate levels.

Geographic Information Systems

The environment is inherently spatial, or geographic, and better consideration of spatial relationships and characteristics may revolutionize understanding and management of environmental processes and conditions. Modern technology, especially in computing and information management, is providing the tools necessary for this improved understanding Specifically, geographic information systems provide the powerful tools needed for a coordinated, cross-disciplinary effort in geospatial modeling and analysis (GMA).

Geographic information systems are collections of capabilities for acquiring, storing, managing, manipulating, analyzing, displaying, and reporting data or information which has locational or spatial attributes. The College faculty recognizes the power and utility of GIS for generating fundamental knowledge about the world, and for many practical environmental applications. These environmental topics cover the breadth of programs at ESF, including natural resources management, environmental and biological science, local and regional planning, engineering, and design of facilities and sites.

In recognition of the importance of GMA to all programs of study and research at the College, the campuswide Council for Geo-spatial Modeling and Analysis (CGMA) was formed in 1991. This unique group consists of faculty and professional staff from the many academic units which are active in the various aspects and applications of GMA. The council emphasizes communications and cooperation in order to develop coherent programs of instruction, research, and public service for many aspects of the ESF community.

The coordination that CGMA can provide will assure continued, efficient, and effective development of the College's expertise and resources in GMA. The council formalizes a unique combination of expertise, interests, and disciplinary strengths, and will help ESF remain a recognized leader in environmental applications of GMA.

Geo-spatial modeling and analysis instruction and research at ESF builds upon existing strengths in mapping science and engineering, including surveying, photogrammetry, remote sensing, hydrology, environmental engineering, and waste management. It also builds on strengths in environmental applications, including environmental science, natural resources management, planning, and design.

Extensive research and advanced instruction facilities are located in the College's Mapping Science Laboratory and the Environmental Design, Planning, and Visual Simulation Laboratory. These facilities continue to expand through support by SUNY, applications research, standard and continuing education programs, and special funding.

Additional resources exist at other facilities at ESF and Syracuse University, including the Advanced Graphics Research Laboratory and an internationally recognized faculty in the areas of cartographic theory

and geographic analysis. The expertise and extensive facilities at ESF for spatial analysis continue to be renowned within disciplines related to environmental science, management, and design.

Any program at ESF can include a component of GIS instruction and practice with proper coordination. In addition, much more concentrated study, application, and research using GIS is available through engineering, environmental studies, forestry, and landscape architecture.

Division of Engineering faculty and students are interested in spatial data acquisition, environmental database development, environmental modeling, site selection, and facility design. The study of GIS in engineering may be coordinated with programs in photogrammetry and mapping, environmental assessment and engineering, image processing, and water resources.

Environmental studies faculty and students are interested in policy issues associated with environmental information, and applications within metropolitan environments. The Faculty's graduate and undergraduate programs offer students special opportunities to pursue an interdisciplinary program that is tailored to their needs, and can include instruction in GIS and GMA applications and research.

Forestry faculty and students use GIS to focus on forest management and planning, and range from inventory analysis through harvest planning to general multiple use forest management. Since resources management is essentially spatial in nature, both the undergraduate program in resources management and the two graduate programs, forest resources management and forest management and operations, benefit from GIS and GMA technology.

Landscape architecture students and faculty are interested in the application of CAD, GIS, and video technologies for landscape analysis, planning, and design. These technologies are integrated into both undergraduate and graduate required coursework, and advanced bachelor's of landscape architecture and master's of landscape architecture students may pursue additional specialized learning in computer applications.

The Tully Campus

The Tully Campus, which is composed of the Heiberg Memorial Forest and the Genetic Field Station is about 25 miles south of Syracuse.

Heiberg Memorial Forest is located on the northern escarpment of the Allegheny Plateau. It includes 3,800 acres of diverse terrain and forest growth. The forest is utilized both as an extensive outdoor teaching laboratory and as a site for intensive research. The Forest Ecosystem Lab, which is a highly instrumented outdoor teaching laboratory, offers a large complex of all-weather classrooms, experimental plantings from throughout the world, and a commercial-scale maple syrup operation. Each fall Heiberg Memorial Forest is the site of an intensive program for environmental and resource management students in a total ecosystem approach to forest community management instruction.

The Wanakena Campus

The Wanakena Campus, located on the Oswegatchie River about 65 miles northeast of Watertown and 35 miles west of Tupper Lake, is the site of the James F. Dubuar Forest and the Faculty of Forestry's Forest Technology Program.

The campus and its 2,800-acre instructional and demonstration forest supports the College's Associate of Applied Science degree program for the training of forest technicians. It is the oldest forest technician program in the country.

The campus is situated on the western plateau of the "Lakes Region" of the Adirondacks, and hosts the Summer Session in Field Forestry, a seven-week course devoted to introductory instruction in field forestry principles and techniques. The course is required for all students entering environmental and resource management.

The Warrensburg Campus

The Warrensburg Campus is located in the southeastern Adirondack region and encompasses the Charles Lathrop Pack Demonstration Forest, an area of some 2,800 acres of heavily forested land noted for its white pine.

The forest has been under intensive management since 1927 for the combined purpose of instruction, research, and demonstration in forestry and allied fields.

Formal offerings in continuing education and various meetings and conferences are held at the forest for practicing professionals and organizations directly associated with forestry and related environmental fields.

The Cranberry Lake Campus

The Cranberry Lake Campus, approximately 1,000 acres of forested property in the north-

western area of the Adirondacks, is the site of ESF's Biological Station.

The College operates an eight-week summer field program in environmental biology at the campus, which is bounded by 150,000 acres of New York State forest preserve lands, by Cranberry Lake, and by isolated forest bogs and beaver meadows.

The extensive facilities are intensely utilized during the summer in a comprehensive curriculum of upper-division and graduate level courses.

Use of the campus before and after the summer session program varies to include individual research projects, cooperative studies with other agencies, and visits by large groups from both the College and outside institutions.

The Newcomb Campus

Located in the central Adirondack Mountains, Newcomb is the largest of the regional campuses and home to the Adirondack Ecological Center (AEC) where extensive studies of animal biology and ecology are conducted.

The AEC is located on the Huntington Wildlife Forest, a 15,000-acre property owned by the College. It provides an exceptional resource for experimentation in ecology and natural resources management. The forest contains Rich Lake and the new $1 million Adirondack Interpretive Center, which is operated by the Adirondack Park Agency and open to the public throughout the year.

This campus is mountainous and contains a wide variety of vegetative types and wildlife. It is used year round for a general research and forest management program participated in by faculty, undergraduate and graduate students, and visiting scientists.

The Field Stations

In addition to its regional campus system, the College operates several field stations, which directly support the instruction, research, and public service programs of the institution.

The 44-acre Forest Experiment Station in Tully is a short drive from the campus in Syracuse, and is used to support main campus academic programs. The station includes a large arboretum, tree nursery, and experimental greenhouse facility.

Adjacent to the Tully campus is the College's Genetic Field Station, which is a 59-acre area devoted to relatively short-term outplantings of plant materials developed during various genetic research projects at the College. The site features an irrigation system and layout of level blocks, which makes it an excellent facility for developing hybrids, grafting, doing experiments, and for research in heritability.

The College owns a magnificent island, featuring the Ellis International Laboratory, in the heart of the Thousand Islands/St. Lawrence River area off the village of Clayton.

Accessible only by boat, the laboratory is in an appropriate spot for the collegewide, cooperative, and international environmental monitoring and research activities conducted in the St. Lawrence Seaway area.

The College's most recent acquisition is a 15-acre facility on Wellesley Island. The island property, formerly a Coast Guard Station, has shore frontage on the American channel of the St. Lawrence Seaway, and is well suited for many types of aquatic studies.

Special Opportunities

Coordinated Programs with Syracuse University

Science Teacher Certification

The College and the School of Education at Syracuse University offer selected undergraduate students an opportunity to prepare for New York State provisional science teacher certification.

Students who earned at least a 2.500 grade point average during their first semester at ESF and transfer students who maintained a 3.000 or greater cumulative grade point average at their previous college are eligible for the program. To receive provisional certification to teach secondary science (grades 7-12) in New York State, students must complete the following requirements:

1. A minimum of 36 credit hours in science, both lower and upper division courses, including at least 24 credit hours in each science for which certification is sought.

Only biology and chemistry may be certified through this program. However, if students have taken at least 24 credits in physics or earth science independent of ESF, they can also be certified in those areas. Certification for teaching general science will be included when the total shows college-level study in at least two sciences.

2. At least 21 credit hours in education at Syracuse University distributed as follows:

EDU	207: Study of Teaching (Secondary)	3
EDU	307: Personalizing Teaching and Learning	3
EDU	308: Strategies of Teaching (Secondary)	3
SCE	535: Practicum in Methods Science Teaching	3
EDU	508: Student Teaching	9
	Total Credit Hours	21

EDU 308, SCE 535, and EDU 508 are normally taken together as a block in the fall of the senior year, with SCE 535 and EDU 308 meeting for the first half of the semester and EDU 508 meeting the second half. EDU 508 is a full-time commitment for about 10 weeks, so other courses must be scheduled with this in mind. SCE 535 is normally offered only in the fall.

3. New York State also requires successful completion of the National Teacher Examination (NTE) for provisional certification.

College students who complete these requirements may then apply through the School of Education at Syracuse University to the state Education Department for provisional certification.

Certification requirements will change for students who receive their degree after September 1, 1993. For more information, contact the Dean of Instruction and Graduate Studies.

Concurrent Graduate Degrees

The College and Syracuse University provide opportunities for graduate students to complete degrees concurrently at ESF and at Syracuse University in either the M.P.A. degree program in the Maxwell School of Citizenship and Public Affairs, the M.A. or M.S. degree programs in the S.I. Newhouse School of Public Communications, the M.S. degree program in the School of Education, or the M.B.A. degree program in the School of Management.

Students must complete at least one semester of graduate level coursework and earn a 3.500 grade point average or better at ESF before being considered for a concurrent degree program at Syracuse University. Students at the Syracuse University College of Law may apply for admission to a concurrent degree program at ESF after completing their first year of law school.

Preprofessional Advising

The College, through Syracuse University, offers preprofessional advising for students interested in careers in medicine, dentistry, veterinary science, and law.

Although some colleges of medicine and dentistry no longer require extensive background coursework in biology, most require a full-year course in general biology, general chemistry, organic chemistry, and physics. Calculus is also required in many cases. In addition to the general science background, colleges of veterinary medicine require coursework in bacteriology or microbiology, and at least one summer of practical experience in the management of poultry, pigs, cattle or horses.

Regardless of the specific prerequisites of a school of medicine, dentistry or veterinary medicine, coursework available at ESF has proven to be valuable to applicants to those professional programs.

All students applying to medical school are encouraged to form a pre-med advisory committee, which can provide letters of recommendation to the schools. The director of Syracuse University's Health Professions Advising Program can be reached at 329 Hall of Languages, (315) 443-2207.

For more information, see ESF's Career Guide Handbook for Biologists, or contact the Office of Career and Counseling Services.

Exchange Programs at Cornell University

The College and the New York State College of Agriculture and Life Sciences at Cornell University provide exchange opportunities so that graduate students can take advantage of special courses, faculty, and research facilities found at the two institutions. Cornell University is in Ithaca, N.Y., which is about 50 miles southwest of Syracuse.

Academic Programs

Degree Programs and Areas of Study

The College is authorized to award degrees in the following programs. Enrollment in other than registered or otherwise approved programs may jeopardize a student's eligibility for certain financial aid programs.

Division of Engineering, page 57.

Environmental and Resource Engineering: M.S., Ph.D., with option in *forest engineering* and areas of study in environmental management, forest engineering, geo-spatial information systems, photogrammetry and remote sensing, or water resources engineering; option in *paper science and engineering* and areas of study in chemistry of pulping and bleaching, colloid chemistry and fiber flocculation, fiber and paper mechanics, process and environmental systems engineering, or pulp and paper technology; and option in *wood products engineering* with areas of study in wood science and technology, wood anatomy and ultrastructure, tropical timbers, wood treatments, or engineered wood products and structures: timber structure design. (HEGIS Code 0999)

Division of Forest Resources, page 63.

Dual Program in Environmental and Forest Biology/Resources Management: B.S. (HEGIS Codes 0999 and 0115)

Faculty of Chemistry, page 66.

Chemistry: B.S., with options in biochemistry, environmental chemistry, organic chemistry of natural products, or polymer chemistry. (HEGIS Code 1905)

Forest Chemistry: M.S., Ph.D., with areas of study in biochemistry, environmental chemistry, organic chemistry of natural products, or polymer chemistry. (HEGIS Code 1905)

Faculty of Environmental and Forest Biology, page 72.

Environmental and Forest Biology: B.S., with elective concentrations in ecology, entomology, environmental microbiology, fish and wildlife biology and management, pest management, forest pathology and mycology, plant physiology, plant science, pre-medical science, science education, or zoology. An accelerated B.S./M.S. track in plant biotechnology is also available. (HEGIS Code 0499)

Environmental and Forest Biology: M.S., Ph.D., with areas of study in ecology, entomology, environmental physiology, fish and wildlife biology and management, forest pathology and mycology, plant science and biotechnology, soil ecology, or chemical ecology. (HEGIS Code 0499)

Faculty of Environmental Studies, page 80.

Environmental Studies: B.S., with areas of study in information and technology, land use planning, biological science applications, policy and management. (HEGIS Code 0201)

Graduate Program in Environmental Science: M.S., Ph.D., with areas of study in environmental land planning, environmental policy and democratic processes, environmental modeling and risk analysis, or water resource management. (HEGIS Code 0420)

Faculty of Forest Engineering, page 86.

Forest Engineering: B.S. (HEGIS Code 0999)

Faculty of Forestry, page 89.

Forest Technology Program: A.A.S. (HEGIS Code 5403)

Resources Management—General Forestry: B.S. (HEGIS Code 0115)

Forest Management and Operations: M.F., with areas of study in the public sector, or the private sector. (HEGIS Code 0115)

Forest Resources Management: M.S., Ph.D., with areas of study in policy and administration, forestry economics, forest management, recreation management, watershed management/hydrology, silviculture, silvics, forest soil science, tree improvement, international forestry, urban forestry, quantitative methods, or resources information management. (HEGIS Code 0115)

Faculty of Landscape Architecture, page 105.

Landscape Architecture: B.L.A. (HEGIS Code 0204)

Landscape Architecture: M.L.A. (HEGIS Code 0204)

Faculty of Paper Science and Engineering, page 112.

Paper Science and Engineering: B.S., with options in science, or engineering. (HEGIS Code 0999)

Faculty of Wood Products Engineering, page 118.

Wood Products Engineering: B.S., with options in construction, or wood products. (HEGIS Code 0999)

Freshman Residency

The College of Environmental Science and Forestry accepts a limited number of students into a Freshman Residency Program that prepares them to enter many of the upper division programs of the College. Students interested in this program should refer to page15 for information on freshman admissions.

Students who meet the admissions criteria and are interested in pursuing a degree in environmental and forest biology, resources management, the dual major of environmental and forest biology and resources management, or chemistry should review the Sciences and Management Track on page 56. Students interested in paper science and engineering, or forest engineering should review the Sciences and Engineering Track on page 55.

Students accepted into either of these tracks complete the required program through a combination of courses taken at ESF, Syracuse University, or advanced standing granted through AP, CLEP or other appropriate programs.

Freshmen who enter through one of these tracks should note that because of opportunities to take some specialized courses at ESF not normally available at pre-ESF institutions, there may be some alteration of their upper division program compared to those who transfer to ESF directly into the junior year program.

Sciences and Engineering Track

Students entering the Sciences and Engineering Track with the intention of pursuing the upper division program in paper science and engineering should observe the following guidelines when planning their program.

Electives taken throughout the full four-year curricula must include at least nine credit hours in social sciences or humanities, at least three of which should be upper division. Humanities coursework deals with branches of knowledge concerned with man and his culture, while social sciences coursework con-

cerns individual relationships in and to society. Traditional subjects in these areas are philosophy, religion, history, literature, fine arts, sociology, psychology, anthropology, economics, and modern languages beyond the introductory skills courses, while modern nontraditional subjects are exemplified by courses such as technology and human affairs, history of technology, and professional ethics and social responsibility.

Subjects such as accounting, industrial management, finance, personnel administration, ROTC studies, and skills courses, such as public speaking and technical report writing, do not fulfill the humanities and social science requirement.

Students who have advanced placement credits are encouraged to work closely with their advisor in order to best prepare for various upper division elective sequences in technology, science, design or management.

Sciences and Management Track

Students entering the Sciences and Management Track with the intention of pursuing the upper division program in environmental and forest biology, resources management, or the dual major of environmental and forest biology and resources management, should consider the following guidelines when planning their program:

Environmental and forest biology: electives taken throughout the full four-year curriculum must include at least nine credits of social sciences/humanities. Electives must also include one course from each of Groups A and B listed below.

Group A
Elements or Principles of Entomology
Invertebrate Zoology
Environmental Microbiology

Group B
Dendrology
Plant Diversity
Forest Pathology

Students must also take a minimum of six credits each of animal and plant sciences, which may include courses from Groups A and B not used as noted above. Finally, a minimum of nine credits in biology at the upper division (numbered 300 or higher) are required.

Students must also take the soils course or one of the following: geology, climatology, earth science, or meteorology.

Resources management: electives taken throughout the full four-year curriculum must include at least nine credits of social sciences (anthropology, economics, geography, history, political science, sociology, and psychology); nine credits of humanities (art, music, foreign languages, philosophy, and literature); nine credits dealing with at least two major resources (forage, minerals, recreation/ amenities, water, wildlife, and wood); and another three credits in the area of forest protection (entomology, pathology, and fire). Of the total of 42 credits of electives in the four-year curriculum, at least six credits must be taken in two or more of the faculties at ESF other than Forestry.

Students may take PSC 122, American State and Local Government and Politics, in place of or concurrent with PSC 121, American National Government and Politics.

Dual major in environmental and forest biology and resources management: electives taken throughout the full nine semester curriculum must include at least nine credits of social sciences/humanities, one course from each of Groups A and B as listed above, a minimum of six credits each of animal and plant sciences, a protection course (entomology, or pathology if not chosen from Groups A and B; otherwise this becomes a biology upper division elective), and a minimum of nine credits of upper division biology (number 300 or higher).

Students may take PSC 122, American State and Local Government and Politics, in place of or concurrent with PSC 121, American National Government and Politics.

Sciences and Engineering Track

Freshman Year

Fall				Spring			
EFB	226	General Botany	4	PHY	211	Physics I	3
CHE	106	General Chemistry	3	PHY	221	Physics Lab I	1
CHE	107	General Chemistry Lab	1	CHE	116	General Chemistry	3
MAT	295	Analytical Geometry & Calculus	3	CHE	117	General Chemistry Lab I	1
WRT	105	Writing Studio	3	MAT	296	Calculus II	3
ESF	132	Seminar for New Students	1	EFB	220	Global Environment	3
		Elective--Hum/Soc Sci	3	APM	153	Computing Methods	3
			18/14*				17

Sophomore Year

Paper Science and Engineering

Fall				Spring			
PHY	212	Physics II	3	FCH	223	Organic Chemistry II	3
PHY	222	Physics Lab II	1	FCH	224	Organic Chemistry Lab II	2
FCH	221	Organic Chemistry I	3	ENG	141	Reading & Interpretation	3
FCH	222	Organic Chemistry Lab I	2	FOR	206	Micro Economics	3
MAT	397	Calculus III	3	MAT	585	Differential Equations	3
CHE	332	Quantitative Analysis	2			Elective--Hum/Soc Sci	3
CHE	333	Quantitative Analysis Lab	1				17
PSE	300	Introduction to Pulp & Paper	3				
			18				

Forest Engineering

Fall				Spring			
PHY	212	Physics II	3	ERE	362	Mechanics of Materials	3
PHY	222	Physics Lab II	1	ERE	222	Engineering Mech - Dynamics	2
ERE	221	Engineering Mech - Statics	3	MAT	398	Calculus IV	3
ERE	225	Engineering Graphics	1	ELE	221	Electrical Science I	3
MAT	397	Calculus III	3	ENG	141	Reading & Interpretation	3
FOR	206	Micro Economics	3	FOR	205	Macro Economics	3
		Elective--Hum/Soc Sci	3				17
			17				

*With the advisor's approval, the actual course load may be less and is dependent on advanced placement credits and future program selection.

Sciences and Management Track

Freshman Year

Fall				Spring			
EFB	226	General Botany	4	EFB	285	Principles of Zoology	4
CHE	106	General Chemistry	3	CHE	116	General Chemistry	3
CHE	107	General Chemistry Lab	1	CHE	117	General Chemistry Lab	1
MAT	295	Analytical Geometry & Calculus	3	EFB	220	Global Environment	3
WRT	105	Writing Studio	3	ETS	141	Reading & Interpretation	3
ESF	132	Seminar for New Students	1	APM	155	Computing Methods	3
		Elective--Hum/Soc Sci	3				17
			18/14*				

Sophomore Year

Resources Management

Fall				Spring			
PHY	211	Physics I	3	FOR	345	Soils	3
PHY	221	Physics Lab I	1	PSC	121	Amer Nat Govt & Politics	3
EFB	320	General Ecology	3	SOC	121	Social Perspectives 3	
FOR	200	Intro to Resource Management	3			or	3
FOR	206	Micro EconomicsI	3	PSY	205	Foundations of Human Behavior 3	
		Elective--Hum/Soc Sci	5			Elective--Hum/Soc Sci	8
			17				17

Environmental and Forest Biology

Fall				Spring			
PHY	211	Physics I	3	FOR	345	Soils	3
PHY	221	Physics Lab I	1	PHY	212	Physics II 3	
EFB	320	General Ecology	3	PHY	222	Physics Lab II 1	
FCH	221	Organic Chemistry I	3			and/or	
FCH	222	Organic Chemistry Lab I	2	FCH	223	Organic Chemistry II 3	
		Elective--Hum/Soc Sci	3	FCH	224	Organic Chemistry Lab II 2	3-12
			15			and/or	
				MAT	296	Calculus II 3	
						Elective--Biology	3-9
							15-18

Dual Major -- Environmental and Forest Biology and Resources Management

Fall				Spring			
PHY	211	Physics I	3	FOR	345	Soils	3
PHY	221	Physics Lab I	1	PHY	212	Physics II 3	
EFB	320	General Ecology	3	PHY	222	Physics Lab II 1	
FCH	221	Organic Chemistry I	3			and/or	
FCH	222	Organic Chemistry Lab I	2	FCH	223	Organic Chemistry II 3	
FOR	206	Micro Economics	3	FCH	224	Organic Chemistry Lab II 2	3-5
		Elective--Hum/Soc Sci	3			and/or	
			18	MAT	296	Calculus II 3	
				PSC	121	Amer Nat Govt & Politics	3
						Elective--Hum/Soc Sci	6
							15-16

Chemistry

Fall				Spring			
PHY	211	Physics I	3	FCH	223	Organic Chemistry II	3
PHY	221	Physics Lab I	1	FCH	224	Organic Chemistry Lab II	2
FCH	221	Organic Chemistry I	3	PHY	212	Physics II	3
FCH	222	Organic Chemistry Lab I	2	PHY	222	Physics Lab II	1
FOR	206	Micro Economics	3	MAT	296	Calculus II	3
SPC	325	Presentational Speaking	3			Elective--Hum/Soc Sci	3-6
		Elective--Hum/Soc Sci	3				15-18
			18				

*With the advisor's approval, the actual course load may be less and is dependent on advanced placement credits and future program selection.

Division of Engineering

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Graduate Program in Environmental and Resource Engineering

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Graduate Studies Coordinator
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The graduate program in Environmental and Resource Engineering (ERE) is concerned with the application of science and engineering to the conservation, restoration, holistic development, and improved utilization of the natural environment and its forest-related resources. It represents synthesis of the professional specialties of three academic faculties which comprise the Division of Engineering. These are the Faculty of Forest Engineering (FEG), the Faculty of Paper Science and Engineering (PSE), and the Faculty of Wood Products Engineering (WPE).

The master of science and doctor of philosophy degrees are awarded in ERE.

The College graduate admissions and academic policies are given on pages 19 and 33. Graduate students in the Division of Engineering generally follow these policies. The minor exceptions are given below.

The Graduate Record Examination is encouraged and expected, but may be waived in exceptional circumstances, on an individual basis. Applicants are required to have a bachelor's degree in science or engineering. At least one year of study in each of the following subjects is expected: biological science, calculus, chemistry, computer science and physics.

With reference to the master of science degree in environmental and resource engineering, only program alternative 1 (Thesis or Project and Defense) and a minimum of 30 credit hours are accepted. Details for program alternative 1 and the distribution of the required 30 credit hours are given on page 33.

Under general requirements for the Ph.D. degree (page 34), the environmental and resource engineering program requires a minimum total of 60 graduate credits, to include a minimum of 30 credits of coursework, and allow a maximum of 30 credits for thesis. As tool requirements, students must demonstrate competence in two of the three following areas: computer science, statistics or advanced mathematics, and a language other than English commonly used in science or engineering practice. The doctoral preliminary examination is required of all students who have not earned a master's degree corresponding to the above alternative 1.

A study plan which formally identifies an individual student's program requirements is developed for each student as soon as possible, but at least during the first year of graduate study. This plan includes all required and elective courses as well as a tentative schedule for completion.

Options, areas of study, and study plans are all developed and implemented using, as necessary, the full resources of the Division of Engineering, the College of Environmental Science and Forestry, Syracuse University, and other SUNY institutions.

Options and Areas of Study

Options are alternative curricular requirements addressing different subjects within a degree program. Areas of study identify subject areas within options in which there is significant and continuing institutional strength.

Within the graduate program in environmental and resource engineering there are three options: forest engineering, paper science and engineering, and wood products engineering. Each option has several areas of study as noted below.

Forest Engineering Option

Environmental Management

Participating Faculty: DUGGIN, HASSETT, HOPKINS, JELINEK, LEE, MCCLIMANS, PALMER, SMITH, TOLL, and select nonengineering faculty.

- Environmental Modeling
- Waste Management
- Energy resources and systems

- Business policy and administration
- Project impact
- Public policy and environmental regulation

Environmental management is an area of study available to M.S. students residing in any of the three engineering faculties, regardless of their "major" area of interest. Required courses in management, waste management, and environmental law provide breadth and perspective for the student aspiring to managerial responsibility in public or private employment. Other courses may be recommended to enhance technical and problem-solving competencies.

Forest Engineering

Participating Faculty: LEE, PALMER

- Mechanization, automation, robotics
- Production management and efficiency
- Site modification
- Access design and construction

A modern update and broadening of the traditional areas of logging and harvesting. Emphasis is placed on engineering approaches to the design and analysis of operational systems for such activities as harvesting, construction, transportation, and land management. Graduate programs are based on a familiarity with operations research models, especially simulation techniques; mechanical and man-machine systems; biologic-geologic interactions; and various selections as needed from the array of engineering sciences.

Geo-spatial Information Systems

Participating Faculty: BROCK, DUGGIN, HOPKINS, LEE

- Spatial data acquisition
- Environmental database development
- Environmental modeling
- Site selection and facility design

This program emphasizes current approaches to using geo-spatial information systems (GIS) to better incorporate spatial data into a wide range of environmental and engineering applications. Both theoretical and applied graduate study focuses on mapping fundamentals, spatial data acquisition techniques, GIS concepts, theory of spatial analysis and modeling, and environmental applications. Additional educational opportunities include systems analysis, environmental sciences and management, automated cartography, computer science, database systems, and information management.

GIS core courses include spatial data acquisition, courses dealing with GIS concepts and theory, a GIS project, and statistics. These courses may be supplemented by many other courses and educational opportunities at ESF and Syracuse University. Graduate study may be integrated with the wide range of engineering, environmental, and resource management study areas at ESF. For example, GIS study can be expanded to hydrologic modeling, photogrammetry and remote sensing, forest management, environmental engineering, and development and location of facilities. Ample flexibility allows programs to be tailored to the interests and strengths of individual students.

Facilities are excellent and expanding, with computers at ESF and Syracuse University, including the SU Advanced Graphics Research Lab. Capabilities include numerous GIS based on a range of computing platforms and offering wide-ranging capabilities for both raster and vector processing. One of the most important GIS resources are the extensive forest properties owned and managed by ESF. These properties provide exceptional opportunities for environmental research and practice with incredible amounts of current and historical data. Related capabilities include advanced image processing systems and a wide range of photogrammetry, remote sensing, and surveying equipment and expertise. Impressive facilities for visual assessment and simulation, parallel and super computing, graphics, and cartography are also available.

Students with engineering, science, or geography backgrounds are particularly suited to this program of study. Numerous opportunities exist for research and financial support. Cooperative and contractual arrangements exist with many organizations, including local and state government agencies, federal agencies such as the U.S. Department of Agriculture, and private engineering and environmental planning firms. Employment opportunities are exceptional.

Photogrammetry and Remote Sensing

Participating Faculty: BROCK, DUGGIN, HOPKINS

- Analytical and digital photogrammetry
- Resources monitoring and assessment
- Digital image processing and classification
- Remote sensing systems analysis

This program provides opportunities for both

theoretical and applied graduate study in sensing systems and the location, measurement, analysis, and description of ground features and earth resources. Studies include in-depth coverage of photographic systems, photogrammetric measurement techniques and applications, and visual image analysis. Digital imaging systems are covered extensively, with an emphasis on earth-orbiting sensors. Advanced courses in photogrammetry and digital image analysis cover theory and techniques for enhancing and/or extracting selected features from an image. Additional courses cover the principles of remote sensing using visible, infrared, and microwave electromagnetic energy. Theoretical courses are complemented by practical exercises, courses organized to work on relevant projects, and independent study opportunities.

Unique opportunities are available to integrate photogrammetry, remote sensing and other aspects of mapping science in a coherent fashion. A core of courses in photogrammetry, remote sensing, Geospatial Information Systems, and statistics may be supplemented by many other courses and educational opportunities at ESF and Syracuse University. This flexibility allows programs to be tailored to the interests and strengths of individual students. All students obtain fundamental coverage of geometric and radiometric theory, analysis, interpretation, and applications. Further specialization through many advanced graduate courses or continued general study is then possible. Study programs may also be extended into GIS, either emphasizing spatial data acquisition for GIS databases or focusing on using a GIS database to improve remote sensing analyses.

Facilities are excellent and expanding, with a focus provided by the Mapping Science Laboratory operated by the Faculty of Forest Engineering. Additional computers are available at Syracuse University, including the SU Advanced Graphics Research Lab. Capabilities include full-featured image processing; a full range of optical/mechanical and analytical photogrammetry instruments; extensive equipment for image interpretation; sensor and atmospheric modeling systems; photographic acquisition and processing; many different GIS; and extensive surveying capacity.

Students with engineering, science, or geography backgrounds are particularly suited to this program of study. Program flexibility also allows specialization in any aspect of the above subjects from within other degree programs (e.g., forestry, landscape architecture, environmental and forest biology, etc.). Numerous opportunities exist for research and financial support. Cooperative and contractual arrangements exist with many agencies, including the U.S. Department of Agriculture, the U.S. Air Force, and NASA. Employment opportunities are exceptional.

Water Resources Engineering

Participating Faculty: HASSETT, LEE, MCCLIMANS, TULLY

- Distributed process hydrologic models
- Parameter estimation
- Real time hydrologic models
- Use of remotely acquired data in hydrologic systems

Studies deal with describing natural and manmade systems for distributing water resources. Emphasis is placed on the engineering and economic reasons for planning and for choosing between alternative solutions to water resource problems within environmental, legal, social and managerial constraints. Analysis techniques using statistics, numerical analysis and computer methodologies are normally included in individual programs. Hydrologic models are being developed as components of geographic information systems.

Paper Science and Engineering Option

Chemistry of Pulping and Bleaching

Participating Faculty: DENCE, FRANCIS, JELINEK, LAI, SCHROEDER

- Reaction mechanisms and kinetics
- Applications of biotechnology
- Chemical modification in mechanical pulping
- Catalytic and activation effects

This area of study focuses on chemical relationships and reactions basic to the manufacture and bleaching of paper pulp, as well as some papermaking operations. Courses in theoretical and applied chemistry are indicated, as well as specialized courses addressed directly to pulping and bleaching. Research centers on these same topics, currently stressing new and improved processes to increase energy efficiency and reduce environmental impact. These include studies of organosolve pulping, delignification and brightening with oxygen, hydrogen peroxide and ozone, enzyme treatment of effluent streams, mechanisms of carbohydrate reactions, and photosensitization of bleached pulps.

Colloid Chemistry and Fiber Flocculation

Participating Faculty: BAMBACHT, HOLTZMAN, LUNER, UNBEHEND

- Paper sheet formation mechanisms
- Wet-end chemistry and physics
- Pulp fines characterization and distribution
- Effects of additives in fiber networks

This study area deals with colloidal phenomena in the papermaking process, in particular the interaction between fibers, fine particles, polymeric additives, and electrolytes in stock preparation and sheet formation. Student programs feature courses in colloid, polymer and physical chemistry, adding appropriate work in mathematics, statistics, and papermaking processes. Research topics fall into two categories: a) fundamental colloidal behavior of particles and b) behavior of paper stock on the paper machine. In the latter, extensive use is made of pilot plant facilities in Walters Hall. Presently under investigation are adsorption-desorption behavior of polymers in papermaking, the chemistry and physics of reactive sizes on model surfaces, and effects of turbulence on sheet formation.

Fiber and Paper Mechanics

Participating Faculty: CÔTÉ, CROSBY, EUSUFZAI, HANNA, KYANKA, LUNER, MARK, THORPE, UNBEHEND

- Fiber orientation and sheet properties
- Micromechanics theory and applications
- Effects of refining and mechanical action
- Microscopy and image analysis techniques

Mechanical behavior of fibers, paper and board, and other fiber networks and composites depends upon variables of material, process and structure at all levels, especially structural anisotropy. Recommended courses focus on mechanics of materials, physics, mathematics and statistics, microscopy, and wood and fiber properties. Research topics are basic in nature, designed to describe and model quantitatively the properties and behavior of fibers and fibrous structures. Current projects include properties of recycled fiber papers, measuring fiber stiffness via image analysis, laser speckle interferometry in strain mapping, effects of beating and fines distribution on wet-web strength, and determination of elastic constants of paper. Several members of the engineering faculty of Syracuse University collaborate closely in this work.

Process and Environmental Systems Engineering

Participating Faculty: HASSETT, HOLM, HOLTZMAN, JELINEK, RAMARAO, TOLL, TULLY

- Behavior and control of units and systems
- Reduction of air and water pollution
- Modeling and simulation of papermaking
- Processing of fibrous wastes

Process engineering links research with development, design, operation, and optimization of manufacturing methods and equipment, seeking improvement through technological innovation consistent with environmental and resource stewardship. Principles of engineering science and mathematics are applied to analysis and dynamic modeling of units and systems, with increasing use of computers in both research and professional practice. Research here includes process dynamics and control, studies of new pulping and bleaching processes, characterization and treatment of waste streams, by-product recovery, and computer simulation of paper processing systems. The extensive laboratories and pilot plant in Walters Hall are strongly supported by computing facilities and expertise on campus, including the Center for Computer Applications and Software Engineering (CASE) of Syracuse University. Appropriate advanced courses in engineering, mathematics, and computer science are available to suit individual student interests and needs.

Pulp and Paper Technology

Participating Faculty: BAMBACHT, CÔTÉ, DENCE, HANNA, HOLTZMAN, JELINEK, LAI, LUNER, MARK, UNBEHEND

- Pulping conditions and fiber properties
- Behavior of fiber fines in papermaking
- Statistical analysis of paper structure
- Recycling of papermaking fibers

Studies in this area deal closely with processes involved in the manufacture of pulp and paper. Courses concerned with this subject are central to a student's program, extended and enriched with selected courses in chemistry, polymers, chemical engineering, process control, applied mathematics, and computer applications. Current research projects include studies of pressurized stone grind-

ing of hardwoods, chemithermomechanical pulping, effects of wet pressing and press drying on sheet properties, pulping of tropical woods, and computer simulation and control of papermaking. Supporting this work is an experimental pulp and paper mill with two complete paper machines, a pressurized refiner and extensive auxiliary equipment.

Wood Products and Engineering Option

Wood Science and Technology

Participating Faculty: DAVIDSON, KYANKA, MEYER, RESCH, L. SMITH, W. SMITH

- Adhesives and Finishing
- Drying and Machining
- Composite Materials
- Mechanical and Physical Properties

Wood science and technology includes research on all aspects of wood utilization other than engineering applications. Wood science stresses studies of wood properties important to the use of wood, or to solve problems in wood utilization by practical applications of this knowledge. The program in wood science and technology at ESF began in the early 1920s, when C. C. Forsaith initiated research relating the structure and properties of Northeastern wood species. These studies were soon expanded to include woods from across North America. As additional scientists joined the College, their research interests broadened to include timbers from around the world. The international reputation of the College's wood scientists continues to grow.

Wood Anatomy and Ultrastructure

Participating Faculty: CÔTÉ, HANNA, MEYER

- Wood formation and cell wall organization
- Cytoskeleton of plant cells
- Properties related to anatomy and ultrastructure
- Electron, light and video microscopy

This area requires that the student develop extensive background in all aspects of microscopy: light, scanning electron, transmission electron and videomicroscopy, including microtechniques for effective preparation of specimens for the appropriate instrument. Wood anatomy studies are basic to wood identification, wood utilization, and physical/mechanical properties. These studies may include woods from other continents, as indicated under the tropical timbers study area.

The field of ultrastructure is very broad with applications in many biological, chemical and materials sciences. Applied to wood, it emphasizes the sub-light microscopic structures (smaller than 0.2 micrometers) found in this natural material, either in the mature form or in its formative stages where various organelles of the living cell may be studied for their roles in producing the mature wood cell.

The behavior of wood in its many applications can be observed and explained via microscopy and related instrumentation such as EDXA (energy-dispersive x-ray analysis). State-of-the-art resources and facilities are concentrated in the Center for Ultrastructure Studies, which provides instruction and research support staff.

Tropical Timbers

Participating Faculty: MEYER, DEZEEUW

- Identification keys and systematics
- Wood properties and end use suitability
- Life zone analyses
- Expert systems

Studies in tropical timbers take many forms, depending on individual student interests. Often students from other countries bring specific problems and materials with them, so their thesis will find immediate application when they return home. The library holdings of the Tropical Timber Information Center (TTIC) and reference wood specimens of the H. P. Brown Memorial Wood Collection, both housed in the Faculty of Wood Products Engineering, are vital to this work.

Research topics may be formulated to answer questions dealing with anatomy, identification, properties or uses of various woods from around the world, again using the TTIC or Brown Wood Collection materials. These may be quite narrow such as anatomy and properties of woods from a particular region, or much broader, such as regional distribution of species and species groups based on life zone research throughout a country or other geographic area. An expert system is currently being developed to answer questions about properties and uses of woods from any part of the world. Combining published information on wood with the latest developments in computer software engineering, the knowledge-based system resulting from this study will aid researchers in answering inquiries or in suggesting new pathways

for intellectual pursuit.

Wood Treatments

Participating Faculty: L. SMITH, W. SMITH, RESCH

- Wood-water relations and wood drying
- Preservative treatments
- Polymer treatments
- Wood coatings

Graduate study in the area of wood treatments allows the student to investigate the scientific basis for the improvement of wood and wood products with various treatments, which include drying, preservative treatments, and coatings. Preparation research includes graduate coursework in wood-water relationships and transport processes and additional study in areas such as wood anatomy and ultrastructure, mechanical properties, wood chemistry, wood microbiology, thermodynamics, and economics.

Current research interests include use of innovative techniques to dry wood, effect of drying method on the subsequent treatability of wood, evaluation of energy usage of several lumber drying technologies, improving wood properties with polymer treatments, and moisture migration through insulated wall structures.

Modern well-equipped laboratories are available to support these research efforts, including a sawmill, high-temperature, dehumidification, and conventional dry kilns; microprocessor data acquisition and control capability; temperature and humidity controlled environment rooms and chambers; wood permeability laboratory; pressure treating retorts; mechanical strength testing equipment; and light and electron microscopy.

Engineered Wood Products and Structures: Timber Structures Design

Participating Faculty: DAVIDSON, KYANKA, HUSSEIN

- Materials science
- Engineering mechanics
- Computer-aided design

Use of wood and wood-based components in situations where reaction to load, duration of load, and factors of safety are predicted or proscribed by engineering codes and principles. Wooden components as small as dowels or as large as bridge beams are considered, using elements of materials science, engineering mechanics and structural analysis. Basic property knowledge, employing theories of elasticity, viscoelasticity and fracture mechanics, is coupled with computer-aided design data to analyze the performance of wood and to solve application problems, such as those encountered in light-frame construction. How such factors as chemical fire retardant treatments, adhesive performance and mechanical fastener design interact with use requirements is considered. National and international design codes and their development play an important role in specifying research areas of current interest and need. Fabrication and testing of actual components is done in the Wood Products Engineering laboratory facilities.

Division of Forest Resources

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Dual Undergraduate Program in Environmental and Forest Biology and Resources Management

Environmental and Forest Biology with Forestry Elective

This dual curriculum is designed to provide students with a strong background in basic biology and forestry. In doing so it meets the core course requirements in two undergraduate curricula: environmental and forest biology, and resources management—general forestry. The dual program is part of a continuum of biology and forestry study opportunities at the College.

Dual program graduates will be highly qualified to work professionally in forested ecosystems. The breadth of training received will prepare them for careers in forestry, forest biology, and other aspects of environmental science in the federal, state, and private sectors. Exposure to diverse courses and extensive field experience enhances their employment opportunities in multidisciplinary programs that are characteristic of contemporary approaches to natural resource management and other professions that address environmental problems.

The dual program requires a minimum of five semesters at the upper division level. Six semesters are often required for those who lack appropriate lower division courses, or who wish to develop specific professional interests in biology or forestry. Students need to be aware of the financial aid implications of one or two additional semesters, especially with respect to the New York State Tuition Assistance Program (TAP), and plan accordingly, starting with the pre-ESF (lower division) semesters. TAP allows a student eight semesters of payments for an undergraduate degree. Dual students may exceed this number and lose a semester(s) of TAP aid if previous payments exceed eight.

Resources Management with Biology Elective

A total of 147 credit hours, 62 prior to matriculation, is required. In addition to the 58 credit hours of upper division core courses listed below, 6 of the elective credit hours must be in plant science, 6 in animal science, and 9 credit hours in upper division (300 or above) biology courses, exclusive of the summer camp experience.

There is less opportunity for free electives in the dual program than in the two curricula which it combines. It is recommended that elective requirements in plant science and animal science address critical support areas such as forest pathology, plant ecology, fish and wildlife management, and entomology. Similarly, forestry electives in silviculture, hydrology, or tree improvement are examples of opportunities in important forestry support areas. Students with specific career and professional goals should make them known to their advisor as early as possible so that proper elective course selections can be made. Course selection is made after consultation with each of two advisors; one from the Faculty of Environmental and Forest Biology and one from the Faculty of Forestry.

There is flexibility in the structure of the curriculum. For example, the required Summer Program in Field Forestry, at Wanakena, may be taken prior to the junior year. This permits courses at the Cranberry Lake Biological Station to be incorporated (see p.74).

To facilitate transfer at the junior level, it is important that students satisfy the lower division course requirements prior to matriculation at the College of Environmental Science and Forestry.

Students entering at the junior level should have successfully completed a minimum of 62 credits which include:

Lower Division Courses

Students entering this program through the freshman admissions option should refer to page 56.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
General Botany and Zoology **OR** General Biology with Laboratory	8
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory[1]	4
General Physics with Laboratory[1]	4
Calculus [1]	3
One additional course with laboratory in either chemistry or physics, or a course in calculus or linear algebra	3-4
English	6
Fundamentals of Sociology **OR** Psychology	3
Political Science (U.S. Institutions)	3
Microeconomics	3
Computer Applications	3
Electives (Social Sciences/Humanities)	9-10
Electives (Biology)	4-5
Total minimum lower division credits	61-64

Upper Division Courses

Junior Year — *Credit Hours*

Fall Semester	ESF 332	Seminar for New Transfer Students	0
	EFB 320	General Ecology	3
	EFB 325	Cell Physiology	3
	Electives[2]		9-10
			15-16
Spring Semester	APM 391	Introduction to Probability and Statistics	3
	EFB 307	Principles of Genetics	3
	EFB 308	Genetics Lab	1
	FOR 360	Principles of Management	3
	Electives[2]		6
			16

Summer Program in Field Forestry[3]

FOR 301	Field Dendrology	1.0
FOR 302	Forest Surveying and Cartography	2.5
FOR 303	Introduction to Forest Mensuration	3.5
FOR 304	Introduction to Forestry	1.0
		8.0

Senior Year *Credit Hours*

Fall Semester	FOR 305	Forestry Concepts and Applications	1
	FOR 322	Forest Mensuration	2
	FOR 331	Forest Influences	3
	FOR 332	Silvics	3
	FOR 333	Silvics Laboratory/Practicum	1
	FOR 334	Silviculture	4
	FOR 345	Soils	3
			17
Spring Semester	FOR 363	Management Models	3
	FOR 465	Natural Resource and Environmental Policy	3
	Electives [2]		9
			15

Fifth Semester *Credit Hours*

APM 492	Forest Biometrics	3
FOR 400	Forest and Resource Economics	3
FOR 470	Management of the Forest Enterprise	3
Electives [2]		6
		15
	Total minimum upper division credits	86-87

A total of 147-150 credit hours is required to complete the B.S. degree in the dual program of environmental and forest biology and resources management.

[1]Students may be admitted with deficiencies in these subject areas. However, deficiencies must be removed as early as possible in the student's program. Students are strongly encouraged to pursue further coursework in these and related areas in consultation with their advisors.

[2]Electives taken throughout the full 4.5 year curriculum must include at least 9 hours of social science/humanities; 1 course from each of groups A and B (A: EFB 336, Dendrology or EFB 340, Shade Tree Pathology or EFB 326, Diversity of Plants; B: EFB 352 (or 351), Entomology or EFB 303, Introduction to Microbiology or EFB 360, Invertebrate Zoology); a minimum of 6 credit hours each of animal and plant science; a protection course (entomology or pathology if not chosen from the A and B list; otherwise, this becomes a biology upper-division elective); and 9 hours of upper-division (300 level or higher) biology.

[3]The required summer program in field forestry may be taken prior to the junior year, permitting courses at the Cranberry Lake Biological Station to be taken in the summer.

The Faculty of Chemistry

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The academic program in chemistry enables the student to develop not only an understanding of chemical phenomena, but also an appreciation for chemistry that can link it to the biological and applied sciences. Programs include courses in traditional areas of chemistry, with additional study in fields pertaining to environmental science and forestry. This broad spectrum of academic offerings is possible through close cooperation with Syracuse University, where a wealth of accessory courses at both the undergraduate and graduate levels are available. Emphasis on the investigative function of chemical science is manifest in the wide array of ongoing research projects within the department.

Undergraduate Program

The Faculty of Chemistry offers three options leading to the bachelor of science degree: biochemistry and natural products, environmental chemistry, and natural and synthetic polymer chemistry. Each option offers an advanced core of studies beyond the basic courses of the classical undergraduate chemistry curriculum. Additionally, students in all options, by selecting proper electives, may be certified on graduation as having completed an American Chemical Society approved curriculum. All options are excellent grounding for professional work at the B.S. level or for advanced graduate study.

Biochemistry and Natural Products

Participating Faculty: BOYER (Plant and Algal Biochemistry), LALONDE (Organic and Natural Products Chemistry), TANENBAUM (Biochemistry and Microbiology), TIMELL (Wood Chemistry), F. X. WEBSTER (Organic Chemistry and Chemical Ecology).

Biochemistry and Natural Products stresses a chemical approach to problems in the life and health sciences. After obtaining a strong foundation in analytical, physical and organic chemistry, these studies are supplemented by advanced courses in natural products chemistry, wood chemistry, spectroscopy, and biochemistry. Professional electives in botany, chemical ecology, genetics and molecular biology provide the background for interactions in the life and health sciences. Research areas include the elucidation of chemical signals by which organisms communicate with each other, the role of trace metals in the growth of microorganisms, and the origin and function of biologically active natural compounds.

Environmental Chemistry

Participating Faculty: BOYER (Environmental Biochemistry), JOHN P. HASSETT (Environmental Chemistry), DAVID L. JOHNSON (Environmental Chemistry), KIEBER (Environmental Chemistry and Oceanography), LALONDE (Chemical Toxicology), TANENBAUM (Biotechnology).

Environmental chemistry stresses applications of fundamental chemical principles to describe and predict behavior of chemicals in the environment. Courses in air and water chemistry are supplemented by advanced courses in analytical, physical, or organic chemistry. A wide variety of courses in areas such as biology, engineering, geology, and environmental policy are also available. Research areas include phase-partitioning of organic compounds in water, characterization of particles in air and water, aqueous photochemistry, sampling techniques for organic compounds, biological alkylation of metals, analysis of organic particles in water, characterization of natural organic matter in soil and water, and behavior of major ions and nutrients in water.

Natural and Synthetic Polymer Chemistry

Participating Faculty: CABASSO (Polymer Chemistry and Membrane Science), CALUWE (Organic Chemistry, Synthetic Polymer Chemistry), SARKO

(Physical and Biopolymer Chemistry), SMID (Organic and Physical Polymer Chemistry), KENNETH J. SMITH, JR. (Physical and Theoretical Polymer Chemistry), TANENBAUM (Biopolymers), TIMELL (Wood Chemistry), WINTER (Physical and Biopolymer Chemistry).

Undergraduates in the natural and synthetic polymer option take advanced courses in mechanisms of polymerization and polymer synthesis, in the physical properties and characterization of polymers, as well as in the laboratory techniques of polymer synthesis and characterization. In addition, two semesters of wood chemistry provide a solid background for chemists planning careers in paper, textiles, membranes, and related areas. Biochemistry is an appropriate elective for students interested in the growth of biotechnologies while environmental chemistry complements this program for students interested in working on problems of chemical waste. The program offers an excellent background both for direct entry into industrial chemistry and graduate study in areas such as chemistry, biotechnology, or polymer science. More than 50 percent of all practicing chemists work on problems involving polymer chemistry.

Lower Division Courses

Students entering this program through the freshman admissions option should refer to page 56.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
Biology with Laboratory	8
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory	8
Physics with Laboratory	8
Economics	3
English	6
Language, Literature or Communication	6
Electives	12-15
Mathematics *	6-9
Total minimum lower division credits	68

*Mathematics through integral calculus. An additional mathematics course beyond integral calculus is required for the B.S. degree.

Upper Division Courses

Junior Year *Credit Hours*

First Semester	ESF 332	Seminar for New Transfer Students	0 ...
	FCH 325	Organic Chemistry III	4
	FCH 380	Analytical Chemistry I.	3
	FCH 360	Physical Chemistry .	3
	Professional Elective [1]		2-4
	Elective		3
	FCH 496	Safety and Orientation (required audit)	1
			16-18
Second Semester	Math or Elective[2]		3
	FCH 381	Analytical Chemistry II.	3
	FCH 361	Physical Chemistry .	3
	CHE 357	Physical Chemistry Laboratory .	2
	FCH 384	Spectrometric Identification of Organic Compounds	2
	Professional Elective[1]		2-3
	Elective		3
			18-19

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[1]A two-semester sequence of professional electives to be taken starting in the junior year should be chosen from the current list of courses, providing a wide range of study in biology, chemistry, ecology, forestry, environmental law, mathematics, geology, physics, biophysics, various engineering disciplines, and others. A copy of this list is available in 228 and 314 Baker.
[2]One course of mathematics or applied mathematics beyond integral calculus is required.

Biochemistry and Natural Products Chemistry Option

Senior Year *Credit Hours*

First Semester	LIB 300	Library Research	1
	FCH 495	Introduction to Professional Chemistry .	1
	FCH 571	Wood Chemistry I	2
	FCH 530	Biochemistry I	3
	FCH 531	Biochemistry Laboratory	2
	Professional Elective/Elective[1]		3
	Elective		3
			15
Second Semester	FCH 498[2]	Introduction to Research	5
	FCH 497	Undergraduate Seminar	1
	FCH 532	Biochemistry II	3
	FCH 573	Wood Chemistry III	2
	Elective		3
	Elective [3]		3
			17
	Total minimum upper division courses		66

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[1]Introduction to Polymer Science, FCH 550 (3 credit hours) is suggested.
[2]Petition by student to the Faculty for replacement of this requirement will be considered to allow time for special interest.
[3]Topics in natural products chemistry, FCH 524 (3 credit hours) is suggested.

A total of 134 credit hours is required to complete the B.S. degree in chemistry with the biochemistry and natural products option.

Environmental Chemistry Option

Senior Year — *Credit Hours*

First Semester	LIB 300	Library Research	1
	FCH 495	Introduction to Professional Chemistry	1
	FCH 510	Environmental Chemistry I	3
	FCH 515	Methods of Environmental Chemical Analysis	3
	Chemistry Elective		3
	Professional Elective/Elective[1]		3
	Elective		3
			17
Second Semester	FCH 498[2]	Introduction to Research	5
	FCH 511	Environmental Chemistry II	3
	FCH 497	Undergraduate Seminar	1
	Electives		6
			15
	Total minimum upper division credits		66

[1]Biochemistry I, FCH 530 (3 credit hours) is suggested.
[2]Petition by student to the Faculty for replacement of this requirement will be considered to allow time for special interest.
[3]Topics in natural products chemistry, FCH 524 (3 credit hours) is suggested.

A total of 134 credit hours is required to complete the B.S. degree in chemistry with the environmental chemistry option.

Natural and Synthetic Polymer Chemistry Option

Senior Year — *Credit Hours*

First Semester	LIB 300	Library Research	1
	FCH 495	Introduction to Professional Chemistry	1
	FCH 550	Introduction to Polymer Science I	3
	FCH 551	Polymer Techniques	2
	FCH 571	Wood Chemistry I	2
	Professional Elective/Elective[1]		3
	Elective		3
			15
Second Semester	FCH 498[2]	Introduction to Research	5
	FCH 552	Introduction to Polymer Science II	3
	FCH 497	Undergraduate Seminar	1
	FCH 573	Wood Chemistry III	2
	Electives		6
			17
	Total minimum upper division credits		66

[1]Biochemistry I, FCH 530 (3 credit hours) is suggested.
[2]Petition by the student to the Faculty for replacement of this requirement will be considered to allow time for special interest.

A total of 134 credit hours is required to complete the B.S. degree in chemistry with the natural and synthetic polymer option.

Graduate Programs

Recent years have seen profound advances in the fundamental knowledge of chemical areas that have special significance for forestry and the environment. The following research areas have received active attention by both faculty and graduate students in the programs: polymer chemistry and physics; wood chemistry; environmental chemistry; biochemistry; chemistry of natural products, including ecological chemistry; and materials sciences.

Requirements for a master of science or doctor of philosophy degree in chemistry include a research thesis, along with an appropriate program of courses at the College and at Syracuse University. Master's and doctoral students must complete a minimum of 18 credit hours and 30 credit hours of graduate level coursework, respectively.

Current research projects encompass polymer chemistry, membrane science, and wood chemistry; biochemistry and microbiology; organic chemistry of natural products and chemical ecology; environmental chemistry of the air, water, and solids.

Biochemistry

Graduate studies in biochemistry reflect the College's interests in microbial, insect, and plant biochemistry. After completing a one year sequence in general biochemistry, students select advanced courses from a range of offerings in chemistry, organismal biology and molecular biology. Advanced courses in biochemistry are available both at ESF and Syracuse University.

A wide variety of research opportunities are available to plant physiology. Areas of faculty interest range from biotechnology to plant physiology. Selective research topics include: The use of microorganisms for the production of speciality chemicals including polysaccharide interconversions (Tanenbaum); the application of bacterial and fungal enzymes in the bioremediation of environmental problems (Tanenbaum); heavy metal cycling in natural systems (Boyer); microbial and algal production of biologically active natural products and their importance in cell biology (Tanenbaum, Boyer, LaLonde); chemical communication between organisms (Webster); marine algal toxins (Boyer); and trace metal/nitrogen physiology of plants and algae (Boyer). Opportunities for research in other areas (e.g., molecular biology) are also available in collaboration with faculty outside the Chemistry Faculty.

Environmental Chemistry

Thesis research for graduate students in environmental chemistry is central to their program of studies and includes both experimental and theoretical considerations. Frequently, the problems to be addressed are transdisciplinary in nature. Thus coursework is carefully selected from areas of chemistry, biology, geology, engineering, mathematics and computer science in order to support the student's particular research needs in conjunction with fieldwork and laboratory experiments. Special topics in analytical-environmental chemistry or for methods development are often arranged.

The environmental chemistry faculty currently have active research interests in both aquatic and atmospheric systems. These include: the thermodynamics and kinetics of binding hydrophobic organic compounds by dissolved humic substances in water, the development of gas partitioning techniques for measuring the extent to this binding in both laboratory and field environments, and the characterization of poorly understood humic substances by techniques such as NMR (Hassett); the study of chlorinated hydrocarbons in the Niagara River-Lake Ontario-St. Lawrence River system, and their interaction with sediments, dissolved substances and organisms (Hassett); the exchange of chlorinated hydrocarbons and other trace organics between aqueous and atmospheric phases in the environment (Hassett, Kieber); understanding the role of organic matter in a variety of atmospheric, aquatic and sedimentary processes (Kieber, Hassett, Johnson); the development of probe systems to study free radical processes and photochemical transformations of dissolved organic matter in natural waters (Kieber); understanding the dynamics of the oceanic carbon cycle and the importance of sunlight-driven photochemical transformations of organic matter in seawater (Kieber); the application of computer assisted SEM/EDXA to individual particle analysis in atmospheric, aquatic and suspended sediment samples (Johnson); the dynamics of calcium carbonate precipitation in hard water lakes (Johnson, Hassett); the biomethylation of As, Sn, and Hg in soil/plant systems (Johnson).

Organic Chemistry of Natural Products

Graduate students in organic chemistry of natural products take a one year course sequence in mechanistic organic chemistry and another in syn-

thetic organic chemistry. Additionally, one semester courses are required in advanced physical chemistry and the organic chemistry of natural products. Courses in biochemistry, inorganic chemistry, statistics and specialized courses in chemistry or biology may be arranged and selected by the student in consultation with faculty.

Research in the field or organic chemistry of natural products takes three paths. These paths are: The isolation and characterization of new natural substances; the synthesis of new or improved syntheses of better known natural substances; and the study of the relation of molecular structure to biological response. Chemical research in each of these areas is coupled to biological testing. Research involving isolation and synthetic chemistry requires the student to develop expertise in separation techniques, such as the several methods of chromatography, and spectrometric identification of molecules. Successful investigation in structure/activity relationships requires the student become familiar with statistical methods of analysis. Current topics of interest to the natural products faculty are the following: Structure and function of natural metal chelators (Boyer); marine and freshwater algal toxins (Boyer); synthesis and structure/activity relationships of nonvolatile, aquatic genotoxins (LaLonde); synthesis of natural products employing sulfur chemistry (LaLonde); and isolation and identification of insect and mammalian pheromones and other semiochemicals such as alleomones and kairomones; synthesis of new natural products (semiochemicals) with particular emphasis on sterochemistry.

Polymer Chemistry

Graduate students in polymer chemistry select their courses from a range of offerings in chemistry, chemical engineering, mathematics, physics, and other appropriate areas. These courses will include either the one year sequence in physical or organic chemistry of polymers and such additional courses as the student and advisor consider necessary. Special topics in a spectrum of polymer fields are offered or can be arranged in consultation with the faculty.

Research is an essential component of any graduate degree program in polymer chemistry. Current topics of research interest within the polymer faculty include the following: preparation, modification, and technology of polymeric membranes (Cabasso); preparation properties and applications of radiopaque polymers (Cabasso, Smid); inorganic polymers (Smid, Cabasso); novel methods of cellulose and cellulosic modification (Caluwe); diffraction methods, NMR, and dynamic molecular modeling approaches to polymer structure determination and prediction (Sarko, Winter); catalysis and mechanisms of polymerization, chemistry of free radicals, radical ions and charge transfer processes (Smid); ion-binding, polyelectrolytes, conductivity, properties of ionic solutions in non-aqueous media (Smid); achieving ultimate properties in polymer materials (Smith); thermodynamics and statistical mechanics of polymer systems (Smith); biomass conversion to industrial polysaccharides (Tanenbaum, Winter).

Research Laboratories

Graduate research laboratories in the Hugh P. Baker Laboratory are well equipped for polymer studies, chemical, and biochemical research. Spectroscopic facilities include ICP, IR, FTIR, GC/MS, UV/VIS, fluorimetric liquid and solid-state multinuclear NMR, and ORD/CD spectrometers. Ultrastructure study facilities include X-ray diffraction equipment and several scanning and transmission electron microscopes. Chromatographic equipment includes instrumentation for analytical and preparative liquid and gas chromatography. Baker Laboratory is fully equipped for the use of radioisotopes in research including a separate radioisotopes lab. Liquid and solid scintillation counters, a multichannel analyzer, and a cobalt-60 irradiation source are available. Other facilities include DSC, torsion pendulum, membrane and vapor phase osmometry, solution and solid-state light-scattering photometers, and a computational environment including PS2 and MAC PCs, work stations and network access to mainframe computing on IBM 3090, VAX 8820 and SPARC 4/490 platforms.

The Faculty of Environmental and Forest Biology

ROBERT L. BURGESS, Chair
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Programs in environmental and forest biology provide students with a firm foundation in basic biology, ecosystem dynamics, and environmental science. They encompass a variety of interconnected disciplines concerned with living systems, and treat not only the form, function, and evolution of organisms, but their life requirements, tolerances, and interactions that are central to the stewardship of renewable natural resources and the maintenance of environmental quality.

The critical importance modern society places upon the utilization of natural resources and the quality of our environment adds new and increasingly diverse dimensions to the services a well-trained biologist can render. The faculty is committed to meet this dynamically changing array of opportunity through coursework enriched by an active program of research that focuses upon upper-level undergraduate and graduate study. Through the addition of selected electives to a required core, undergraduates may focus their program toward a special biological field (see p. 74) or toward future graduate study. Graduate students may develop a course of study under the guidance of a major professor and graduate committee within any of several areas of study (see p. 76).

The academic programs stimulate interest in the recognition and understanding of plants, animals, and protists, and deal with dynamic changes in biological systems in the context of the broad fields of ecology, physiology, genetics, and evolution. This is accomplished by an integration of coursework with a strong research program.

Undergraduate Program

The curriculum for the bachelor of science degree is built around a core of required courses which provide the student with a general education, a basic background in the principles of the biological and the physical sciences, and an orientation to forest resources. Its design develops breadth in biology as well as depth in a special biological field. Although individual course selections may vary, all students major in environmental and forest biology and each, with an assigned advisor, develops a

Lower Division Courses

Students entering this program through the freshman admissions option should refer to page 56.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
General Botany and Zoology OR General Biology with Laboratory	8
General Chemistry with Laboratory, 2 semesters	8
Organic Chemistry with Laboratory, 1 semester*	4
Physics with Laboratory, 1 semester*	4
Calculus, 1 semester*	3-4
One additional course with laboratory in either Chemistry, or Physics, or a course in Calculus, or Linear Algebra, 1 semester	3-4
English	6
Social Sciences, Humanities**	9
Electives (recommended in Biology, if available)	13-15
Total minimum lower division credits	60

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*Students are strongly encouraged to pursue further coursework in these and related areas in consultation with their advisors.
**A course in technical writing and/or speech is highly recommended as part of the social science humanities group.

special plan of study.

A dual-major program is available that meets the undergraduate requirements of environmental and forest biology and of resources management (see p. 63).

A total of 125 credit hours is required for the bachelor of science degree. In addition to the core courses and Summer Field Experience specified below, at least 21 hours in biology at the 300 level or above must be completed. Of these, at least 15 must be from courses at ESF. Six of the 21 credit hours must involve subject matter in plant science and six in animal science. The balance of the required hours is chosen in consultation with the advisor.

Summer Field Experience

Between the junior and senior years, each student completes a minimum of five semester credit hours (or equivalent) during residence in an approved academic program in field biology. This requirement is usually met by the appropriate selection of courses at Cranberry Lake Biological Station (CLBS) where courses are offered during each of two sessions. Earning five credits at one

Upper Division Courses

Junior Year

			Credit Hours
First Semester	ESF 332	Seminar for New Transfer Students	0
	EFB 320	General Ecology	3
	EFB 325	Cell Physiology	3
	Electives		9
			15
Second Semester	APM 391	Introduction to Probability and Statistics	3
	EFB 307	Principles of Genetics	3
	EFB 308	Genetics Laboratory	1
	Electives		8
			15

Summer Field Experience—Must be met as described on page 73 5

Senior Year

		Credit Hours
First Semester	Electives	15
Second Semester	Electives	15

Electives *must* include at least one course from each of groups A, B, and C.

A	B	C
Elements or Principles of Entomology	Dendrology I	Climatology
Invertebrate Zoology	Plant Diversity	Earth Science
Environmental Microbiology	Forest Pathology	Geology
		Meteorology
		Soils

Additionally, students must take a minimum of six credit hours each of animal and plant science and this may include courses from lists A and B not used above.

Total minimum upper division credits 65

A total of 125 credit hours is required to complete the B.S. degree in environmental and forest biology.

session satisfies the requirement; any additional courses taken in the other session count as elective credits.

Alternatively, other biological field stations may be attended to earn the minimum five semester hours credit (or equivalent). Petitions requesting this alternative must include course descriptions and the program contemplated and be submitted to the curriculum director at least one month prior to the end of the spring semester preceding the summer program. A current file of alternative stations and course descriptions is maintained by the director of the Cranberry Lake Biological Station.

Cranberry Lake Biological Station

Cranberry Lake and its environs are ideally suited for an advanced biology summer program. The surrounding topography is rolling hill and lake country dotted with numerous small ponds, closed bogs, and stream drainages. The lake is the third largest body of water in the Adirondacks. Because 80 percent of the shoreline is in State ownership, the lake remains unspoiled by recreational developments and pollution problems. Much of the original forest cover in the region was harvested 80-100 years ago; today a rich variety of community types occupies those sites as the vegetation reverts to natural conditions. The remaining virgin forests also provide students with many examples of stable ecosystems, each type reflecting the particular environmental conditions controlling forest development. A wealth of wildlife parallels the variety of cover types. The area provides easy access to a wide range of additional ecosystems ranging from bog to alpine types.

Facilities include four classroom-laboratories; dining facilities for 120; faculty quarters and cabins; an administration building; 12 cabins housing 6-8 students each; a recreation hall; and several smaller, supporting buildings.

The program extends through June and July, divided into two sessions. Courses are designed to emphasize and effectively utilize the unique nature of this Adirondack setting, and all involve field trips each day into the surrounding forest and aquatic ecosystems.

Information about the summer program, including courses and fees, may be obtained from the Director, Cranberry Lake Biological Station, State University of New York College of Environmental Science and Forestry, Syracuse, New York 13210.

Electives and Elective Concentrations

The curriculum meets general requirements for graduate study and for a wide range of federal, state, municipal, and private biology positions. Those training for biological positions in federal and state service should review civil service publications and become familiar with specific course requirements early enough to make timely elective choices. Students are urged to use some elective time to enhance their communications skills. Courses in technical writing, applied communications or a foreign language (as approved by their faculty advisor) are especially useful.

Listed below are 11 elective concentrations that focus on specialized fields of biology. Further information on these can be found in the Career Guide Handbook for biologists available from the Faculty office.

Ecology. The purpose of the undergraduate elective concentration in ecology is to give students a basic knowledge on the relations of organisms to their environment and how these affect their distribution and abundance. There are four major areas in ecology: organismal ecology, population-evolutionary ecology, community ecology, and systems ecology. Undergraduate students choose courses from at least two of these four areas to obtain training beyond that of the general course in ecology. The practical and theoretical application of ecology is emphasized through courses at both ESF and Syracuse University as well as at the Cranberry Lake Biological Field Station. Students in environmental and forest biology are encouraged to select courses compatible with their interests and educational goals. Examples of possible course selections and a listing of ecology courses are given below.

Students in this concentration will have an excellent background to pursue graduate work in ecology and to develop ecological expertise. Preparation in ecology will serve students who pursue further training or employment in those areas of research, teaching, or management which apply ecological principles.

In addition to core biology courses, students in the ecology concentration take one semester in Undergraduate Seminar in Ecology (EFB 492), plus at least one course from two of the following four categories:

1. *Organismal Ecology*
   EFB 445 Plant Ecology
   EFB 448 Physiological Ecology of Plants
   EFB 480 Principles of Animal Behavior
   EFB 505 Microbial Ecology

EFB 554 Aquatic Entomology
EFB 489 Animal Physiology
BIO 427 Physiological Plant Ecology

2. *Population/Evolutionary Ecology*
EFB 309 Introduction to Quantitative and Population Genetics
EFB 410 Evolutionary and Systematic Biology
EFB 515 Population Ecology
BIO 343 Population Biology
BIO 401 Evolution and Population Genetics[1]
BIO 402 Demography and Behavioral Ecology[1]
BIO 410 Seminar in Population Ecology
BIO 431 Population Genetics

3. *Community Ecology*
EFB 487 Ecology of Adirondack Fishes
EFB 578 Terrestrial Community Ecology
BIO 403 Physiological and Community Ecology[1]

[1]Tutorial

4. *Systems Ecology (Ecosystem, Landscape, Global)*
EFB 498 Ecosystems
EFB 518 Systems Ecology
EFB 542 Freshwater Wetland Ecosystems

Entomology. Insects play significant roles, both beneficial and detrimental, in their interactions with man, natural resources, and environment. Courses enable a student to fulfill requirements of civil service and a variety of other employers. Program strengths are in forest entomology, medical entomology, pest management, and environmental toxicology.

Environmental Microbiology. Microbiology is a dynamic and exciting science that deals with bacteria, molds, algae, yeasts, protozoa, rickettsiae, and viruses: their roles in industry, disease, the environment, and everyday life. Careers in microbiology are available throughout the public and private sectors, and related to many different professions and industries.

Fish and Wildlife Biology and Management. A basic and applied program in fish and wildlife biology, including management and behavior, is provided for students whose objectives are to develop professional skills in the biology and management of these natural resources. This program offers a broad education in the biological sciences with a strong foundation in ecology. Course selections are readily tailored to meet certification requirements for The Wildlife Society and the American Fisheries Society. Specialized and advanced courses are offered in fishery biology, wetland ecology, wildlife ecology and management, limnology, habitat analysis, and wildlife techniques.

Forest Pathology and Mycology. Protection of vascular plants and wood products from invading organisms, such as fungi, is basic to forest productivity, effective wood product use, and the maintenance of environmental quality. Program strength is in the ecological, physiological, genetic, and environmental aspects of disease. Students may train for positions in forest pathology, mycology, pest management, plant quarantine, or diagnostic laboratories. Opportunities for employment exist with federal, state, and private agencies.

Pest Management. Modern control of insects and disease dictates practices appropriate to maintaining an acceptable environmental quality. Through proper course selection, students are able to achieve training in wise selections of methods for an integrated approach to pest management. Training thoroughly prepares students for state examinations required for pesticide applicator's certification.

Plant Physiology. Plant physiology, part of the broader science of botany, concerns the life processes that occur in plants. Career opportunities are available in federal, state, and local governments through their extensive testing and monitoring programs. Additionally, positions are available in agriculture and forestry concerning pathogenic microorganisms and physiological mechanisms of infection.

Plant Science. Students may prepare for a wide variety of opportunities in the botanical professions. Essential to understanding plants are their biochemical and physiological processes; their interactions with the environment and with one another; with animals and other organisms; their genetic makeup, evolution and classification. Requirements may be satisfied for technical positions in areas such as botany, plant ecology, tree genetics, plant physiology, horticulture, tree maintenance, or plant quarantine.

Pre-Medical Science. Completion of all core and elective requirements in environmental and forest biology will prepare students for application to medical schools of their choice. Premedical programs are not formally structured

curricula, but most often consist of opportunity to take necessary coursework in biology, chemistry, mathematics and physics that will prepare students for required admission testing procedures. Environmental and forest biology offers an abundant array of courses and opportunities for students interested in careers as physicians or in veterinary medicine.

Science Education. Through special arrangements with Syracuse University, students in environmental and forest biology can couple a strong program in basic biological sciences with necessary education courses required to qualify for certification as science teachers in grades 7-12 under New York State regulations. Advisors will guide students interested in this program to the appropriate coursework and the mechanisms required to successfully complete a program in science education.

Zoology. A broad program is provided for the student whose objectives are to go on for graduate study or to further training in physiology, soil invertebrate ecology, animal behavior, or animal ecology. Some opportunities with federal and state agencies are available at the baccalaureate level.

Internship Program

A variety of internships are available, either in the summer or one semester of the academic year. These are arranged in cooperation with the student's advisor. Agencies actively involved with the internship program include the U.S. Fish and Wildlife Service, New York State Department of Environmental Conservation, and the National Park Service.

Accelerated Five-Year BS/MS Track In Plant Biotechnology

Biotechnology, the use of biological techniques and processes to provide for the well-being of mankind, has arisen with the recent expansion of our understanding of cell biology that permits the manipulation of molecules involved in reproduction and specific biological systems. We now have the ability to design better biological agents and organisms for human benefit. The undergraduate component of this integrated course of study prepares students not only for graduate work in plant biotechnology, but also for career opportunities available at the baccalaureate level.

The undergraduate track includes all requirements for the bachelor of science degree in environmental and forest biology. In addition, courses in plant science, chemistry and biochemistry, and introductory courses in genetic engineering and tissue culture technology are required.

The five-year accelerated bachelor of science/master of science track in plant biotechnology is an opportunity within the graduate program in environmental and forest biology. Admission to the M.S. degree is open to all students with strong backgrounds in biology and chemistry. Students completing the undergraduate component at ESF must satisfy the normal graduate admission requirements of the College.

The accelerated M.S. program requires a minimum of one year plus two summers of full-time study. Students will usually undertake the thesis/project program alternative. Course requirements include plant recombinant DNA technology, genetic engineering and biotechnology; plant virology; seminars and laboratory techniques. Graduates will be well-prepared for professional careers as highly trained technical specialists, in research associated with industrial and governmental laboratories, or for continuing graduate study in a Ph.D. program.

Graduate Program

The graduate program in environmental and forest biology is organized in eight interdependent areas of study that provide comprehensive coverage within specific interest areas. Faculty in each area define the scope of subject matter, recommend acceptance of students and guide them in a course of study. It is opportune for students to develop a degree of specialization in at least one large taxonomic group (e.g., fungi, plants, vertebrates, insects) to assure a useful mix of talents.

Most students seeking the M.S. degree include a research thesis and its defense (see p. 33). There also is a program alternative to earn the degree with 42 hours of coursework specified by the student's advising faculty. All who seek the Ph.D. must include original research and a thesis or its equivalent in the form of refereed publications.

The center of activity is Illick Hall, with laboratories, classrooms, controlled spaces, and equipment in a modern building in which 8,000 square meters of working space is available for graduate study and research. Laboratories, many of them temperature and temperature-humidity controlled, and one sound-controlled, are provided for study and research in plant development, physiology, tissue culture, molecular biology, biochemistry and toxicology, ecology, and animal behavior. An herbarium, mycological collections, insect and

other invertebrate collections, and the Roosevelt Wildlife Collection of vertebrates are maintained as resources for the academic program. Eight rooftop glasshouse units, three of them air-conditioned and one incorporated into a five-room indoor-outdoor insectary, are important to the full array of interests in plant science and plant-animal interactions.

Also available to students and faculty is a variety of sophisticated instrumentation: convenient access to a computer center; radioisotope counting equipment, including liquid scintillation spectrometer and Cobalt-60 source; diverse analytical equipment and measuring devices; gas-liquid chromatography; and a comprehensive analytical expertise. The N. C. Brown Center for Ultrastructure offers coursework and research in scanning and transmission electron microscopy.

Supportive to the program are the academic resources, including courses, of Syracuse University, SUNY's Health Science Center and the several campus facilities described elsewhere in this catalog. Our students also participate in courses and utilize faculty and facilities at Cornell University and several SUNY campuses in cooperative exchanges.

Excellent field sites and facilities are available for research in all aspects of the program in nearby or moderately distant locations. In addition to the College's several campuses and field stations that offer a broad diversity of forest types, sites, and conditions, there are New York State Department of Environmental Conservation lands, the Montezuma National Wildlife Refuge, the Adirondack Mountains, and the transition zones near Lake Ontario, Oneida Lake, and Cicero Swamp. These areas offer a variety of habitat diversity from highlands to aquatic-terrestrial zones. The ponds, streams, and lakes in Central New York and the St. Lawrence River are regularly used by graduate students in aquatic ecology, fishery biology, and ecosystem science.

Further academic advantages stem from the urban setting of the Syracuse campus. Nearby Onondaga Lake is a prominent feature that serves as a focus for many research and teaching activities. The Greater Syracuse area provides a convenient laboratory for studies basic to urban ecology: the growth and protection of woody vegetation, greenspace maintenance, the utilization of waste beds for plant growth, the detoxification of pollutants, and the restoration of terrain stripped of vegetation. Disposal of industrial and human wastes requires deeper understanding of the role of plants, animals and microorganisms in the biodegradation of organic matter. The conversion of organic materials into useful fuel, into additives for plant growth, or into protein feeds for domestic animals are stimulating topics.

Eight areas of study are available: ecology, entomology, environmental physiology, fish and wildlife biology and management, pathology and mycology, plant science and biotechnology, and soil ecology. One, chemical ecology, is shared with the Faculty of Chemistry. Additional information on each of these areas of study is available by telephone or written request to any of the professors listed.

Areas of Study

Ecology

ALEXANDER (Vertebrates, Wetlands), ALLEN (Forest Insects), BALDASSARRE (Wetlands), BROCKE (Wildlife, Bioenergetics), BURGESS (Forest Ecology), CHAMBERS (Wildlife), DINDAL (Invertebrates, Soil Ecology), HALL (Systems Ecology), KURCZEWSKI (Insect Behavior), LEOPOLD (Dendrology, Community Ecology), MITCHELL (Biogeochemistry), MÜLLER-SCHWARZE (Vertebrate Behavior), NAKAS (Microbiology), NORTON (Soil Ecology), PORTER (Vertebrate Ecology), RAYNAL (Physiological Ecology, Demography), RINGLER (Aquatic Ecology, Fish Behavior), SCHAEDLE (Plant Nutrition), SHIELDS (Vertebrate Behavior), SIMEONE (Forest and Wood-boring Insects), STEWART (Aquatic Ecology), TURNER (Physiological Ecology), VANDRUFF (Wildlife), WERNER (Limnology).

Adjunct Faculty: MONHEIMER (Fish and Wildlife Ecology), CHEPKO-SADE (Primate Ecology).

This integrative study area allows students to investigate the relationships of organisms to their environment and those factors which affect their distribution and abundance. Both the practical and theoretical applications of ecology areemphasized through courses and research. There are four major areas in ecology: organismal ecology, population-evolutionary ecology, community ecology, and systems ecology. In consultation with the student's steering committee, courses are chosen from these areas, as well as other disciplines. Specific research may encompass any of the four major areas of ecology and entail the study of the distribution and abundance of organisms, community structure including trophic relationships, diversity, succession, and ecosystem properties, such as patterns of energy transfer and biogeochemical cycling.

Entomology

ABRAHAMSON (Forest Insects, Pest Management), ALLEN (Forest Insects, Population Ecology), BREZNER (Physiology), CASTELLO (Virology, Insect Vectors), KURCZEWSKI (Morphology, Taxonomy, Behavior), MILLER (Pest Management), MITCHELL (Population Ecology), NAKATSUGAWA (Toxicology), NORTON (Soil Arthropods, Systematics, Insect Larval Taxonomy), RINGLER (Aquatic Entomology), SIMEONE (Forest and Wood-inhabiting Insects), TEALE (Insect Pheromones), TURNER (Physiology).

Adjunct Faculty: APPLETON (Toxicology), HOWARD (Medical Entomology).

Graduate study opportunities prepare students in the basic aspects of insect life and the role of insects in relation to man and his environment. The wide range of effects stemming from insect activity, from the beneficial to the deleterious, allows for a variety of research subjects in which insects play a major role. Thesis topics may concern insects that affect forests, shade trees and wood products, those relating to the health and well-being of man and those playing key roles as parasites and predators of pest species. Current research areas include population dynamics of forest defoliators, pheromone communications among beetles and moths, speciation of insects as understood through behavioral and cytogenetic, study effects of larvicides and fish predators on stream benthic insects, natural control of insects in forest systems, and basic biochemistry of insect detoxification mechanisms.

Environmental Physiology

BREZNER (Insect Physiology), CASTELLO (Plant Virology), GRIFFIN (Fungus Physiology), MITCHELL (Environmental Energetics), NAKAS (Microbial Physiology), NAKATSUGAWA (Insect and Vertebrate Toxicology), SCHAEDLE (Plant Physiology), TURNER (Animal Physiology), WILCOX (Plant Physiology).

Environmental physiology provides students with advanced training in the nature and control of biological processes. Current interests include mechanisms of action of plant growth hormones; biochemical regulation of seed germination; plant and microbial enzymology; virology; toxicity and disposition of insecticides and environmental toxicants in vertebrates; production and action of plant phytoalexins and antibiotics; plant defenses against phytophagous invertebrates; thermal exchange in bird eggs; mycorrhizae, ion transport; mineral nutrition, cambial physiology and photosynthesis.

Fish and Wildlife Biology and Management

ALEXANDER (Vertebrates, Herpetology), BALDASSARRE (Waterfowl), BROCKE (Vertebrates), CHAMBERS (Vertebrates), MULLER-SCHWARZE (Vertebrate Behavior), PAYNE (Ornithology), PORTER (Vertebrate Ecology), RINGLER (Fisheries, Aquatic Ecology), SHIELDS (Vertebrate Behavior), STEWART (Fisheries, Aquatic Ecology), TURNER (Vertebrate Physiology), VANDRUFF (Vertebrates, Ornithology), WERNER (Limnology, Fisheries).

Adjunct Faculty: BROWN (Wildlife Ecology), CHEPKO-SADE (Primate Behavior), MONHEIMER (Wildlife Ecology), SCHACHTE (Aquaculture, Pathology).

Study in this area provides students with advanced preparation in biological concepts of fish and wildlife populations as they relate to proper management. Increasing concern for these wild animal resources has been matched by strong student interest in educational programs which prepare them for careers in the fish and wildlife professions. Graduate education is rapidly becoming a universal prerequisite to employment as a professional fisheries or wildlife biologist.

Areas of research include population habitat relationships, predator ecology, fish behavior, wildlife in Adirondack ecosystems, urban wildlife relationships, endangered species studies, feeding ecology of fishes, stream ecology, Great Lakes fisheries, ecology of larval fishes and homing behavior of fishes.

Forest Pathology and Mycology

ABRAHAMSON (Forest Pathology, Entomology), CASTELLO (Forest Pathology), GRIFFIN (Fungus Physiology), MANION (Forest Pathology), NAKAS (Microbiology), POWELL (Plant Pathology and Molecular Biology), ROGERS (Plant and Molecular Biology), VALENTINE (Genetics), WANG (Mycology), WILCOX (Mycorrhizae), WORRALL (Forest Pathology).

Adjunct Faculty: HAMMILL (Mycology)

Forest pathology and mycology trains students to develop an expertise responsive to the increas-

ing pressures on forest and shade tree systems for wood fiber, public services, and amenities. This requires new sophisticated levels of disease understanding, disease control, a broad knowledge of fungi, bacteria and viruses, their environmental impacts and their roles in biodeterioration. Areas of interest include: environmental, fungal and viral tree diseases; mycorrhizae; wood decay and biodegradation processes; monitoring and impact assessment of disease in forest and urban tree systems; chemical and biological control of tree diseases; epidemiology of tree diseases and the genetics of resistance to tree diseases and to pathogen variability; physiology of fungus growth and development; taxonomy and biology of decay and imperfect fungi; and fungus ultrastructure.

Plant Science and Biotechnology

BURGESS (Ecology), CASTELLO (Virology), GRIFFIN (Mycology, Fungus Physiology), LEOPOLD (Dendrology, Community Ecology), LOWE (Mycology), MANION (Pathology), NAKAS (Microbiology), POWELL (Plant Pathology and Molecular Biology), RAYNAL (Ecology, Taxonomy), ROGERS (Plant and Molecular Biology), SCHAEDLE (Physiology), SILVERBORG (Pathology), TEPPER (Anatomy, Morphogenesis), VALENTINE (Genetics), WANG (Mycology), WILCOX (Physiology, Mycorrhizae), WORRALL (Pathology).

Adjunct Faculty: GOULD (Environmental Microbiology), MANTE (Biotechnology), MILLER (Physiology).

Plants, as the base for ecological food chains, serve as the structural and functional foundation of natural and managed systems. The plant science and biotechnology area of study provides opportunity in a broad range of specialties fundamental to the understanding of plants and their interaction with other organisms and for specializing in plant biotechnology. Emphasis is on forests and related plant systems. Current research interests include: dynamics of plant communities as affected by man and the environment; mechanisms of plant succession; epidemiology of forest and urban tree diseases; decay, discoloration and biomodification of wood; taxonomy, physiology, growth and ultrastructure of fungi; heritability of wood properties and disease resistance of trees; biochemistry and physiology of plant growth regulators; photosynthesis; mineral nutrition; mycorrhizae; morphogenesis in shoot and root systems; and plant tissue culture.

Soil Ecology

DINDAL (Invertebrates), MITCHELL (Invertebrates, Energetics), NAKAS (Microbiology), NORTON (Invertebrates), WANG (Mycology)

Soil ecology includes the study of interrelationships of soil-inhabiting organisms (as individuals, populations and communities) with their biotic, chemical, and physical environments. This field is a frontier of science because of the myriad of undescribed species of soil-dwelling arthropods, nematodes and annelids, and the wealth of incompletely understood symbiotic relationships. Soil ecology deals with fundamental aspects of biodegradation and nutrient cycling, important for improvements in crop culture and enlightened waste disposal.

The soil ecology area of study is supported by courses in physical aspects of soils, plant and animal taxonomy and general ecology.

Chemical Ecology

MÜLLER-SCHWARZE (Vertebrate Pheromones), SILVERSTEIN (Pheromone Chemistry), SIMEONE (Insect Pheromones), TANENBAUM (Microbial Chemistry), TEALE (Insect Pheromones).

The area of study in chemical ecology is offered by collaboration between the Faculty of Environmental and Forest Biology and the Faculty of Chemistry. Interested students should apply to the Faculty of major interest, which will have prime responsibility for setting requirements. Faculty from both areas can aid in the development of a plan of study enabling a student to acquire sophisticated skills in either chemistry or biology and an ample understanding of the other to grapple with problems requiring an understanding of both.

As a relatively new interdisciplinary endeavor, workers in this field attempt to understand organismal interactions, both intra- and interspecific, mediated by chemical substances such as hormones, pheromones, kairomones and phytoalexins. These occur at all taxonomic levels: between uni- and multicellular organisms, microbes and plants, plants and plants, plants and animals, microbes and animals, and animals and animals. Study of such interactions has been accelerated in recent years through joint efforts of biologists and chemists in meaningful research accompanied by a growing body of literature.

The Faculty of Environmental Studies

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ROBERT D. HENNIGAN, Professor and Chair (Environmental Policy and Management, Water Resources and Water Quality Policy and Management)

Faculty: DALL (Environmental Law and Policy), FELLEMAN (Land Use), SANDERS (Economic Development, Urban and Regional Planning, Urban Ecosystems, Quantitative Modeling and Methods), SMARDON (Landscape and Environmental Planning, Visual Resource Analysis, Environmental Assessment/Administration, Wetland Assessment).

Participating Faculty: BLACK (Water and Related Land Resources), COUFAL (Silviculture, Environmental Ethics, Forest Education, Policy and Management), GRATZER (Forest Recreation, Forest Management), HALL (Systems Ecology), J. M. HASSETT (Environmental Modeling, Waste Management, Public Policy and Environmental Regulation, Energy Resources and Systems), J. P. HASSETT (Environmental Chemistry), HERRINGTON (Forest Management-Computers, Micrometeorology), HORN (Forest Management, Law), LEWIS (Community Land Use Planning, Planning Theory, System Dynamics, Modeling and Simulation), NAKATSUGAWA (Toxicology, Insect and Vertebrate Toxicology, Microbiology), J. PALMER (Landscape Perception, Design Evaluation, Social Impact Assessment, Environment and Behavior Research Methods), SHANNON (Forest Policy, Forest Resources Sociology), TOLL (Environmental Monitoring, Risk Assessment, Environmental Policy).

Adjunct Faculty: EFFLER (Water Quality Modeling), KARP (Environmental Land Use Law), O'LEARY (Public Administration and Law, Environmental Policy), SIEGEL (Groundwater Modeling)

The Faculty of Environmental Studies hosts two degree programs, the bachelor of science in environmental studies (ES) and the graduate program in environmental science (GPES), which awards both M.S. and Ph.D. degrees.

The GPES and the ES programs address environmental issues of high public concern and rely upon the scientific and professional expertise of the College faculty. These programs provide for the study of environmental systems and the interrelationships of human and natural systems. Both are guided by a concern for finding and promoting wise public policies for natural resource and environmental management. Each program provides a set of core or foundation courses dealing with understanding and analyzing complex environmental systems in their human context, and a range of student choice in choosing interdisciplinary subjects for concentration. Faculty offering instruction and advisement for these programs are drawn from the academic units of the College, and work with students to shape their programs of study to blend student interests with program goals.

Bachelor of Science in Environmental Studies

The bachelor of science in environmental studies (ES) program is concerned with the interrelationships among the natural environment, natural resources, and human society, including society's institutions. The goal of the program is to educate students to be sensitive, articulate, and knowledgeable about complex environmental issues facing contemporary society. To achieve this, the ES program promotes (a) sound preparation in technical and scientific subjects and skills, (b) grounding in an environmental area of study, and (c) a synthetic or holistic viewpoint and understanding of environmental concerns.

The B.S. degree is granted at the end of four years and requires the successful completion of 121 credit hours of coursework. The program provides for a pyramidal sequence of study. At the lower division, students acquire a basic knowledge in the natural and social sciences, receive exposure to the humanities, and learn useful communications and analytic skills. Students then enter the ES program as juniors with 60 lower division credits. At the upper division, the student is provided a balanced understanding of natural and social processes as they relate to the environment, an additional set of useful skills and methods, and a progressive integration of this knowledge through an environmental area of study, leading to a synthesis of learning in the senior year.

The scope and complexity of coursework within the ES program demands both discipline and com-

mitment from students seeking this degree. A clear sense of purpose and objectives are necessary to pursue the curriculum beneficially. To meet each student's objectives fully, a close working relationship between faculty and the student is also necessary. A general orientation for upper division study is provided in the program's four study areas, one of which is chosen by the student during the admissions process, before undertaking upper division study. These study areas are: (a) information and technology, (b) land use planning, (c) biological science applications, and (d) policy and management. Within these general areas of study, students are provided flexibility to further pursue their environmental interests.

Students receiving the B.S. degree have pursued graduate study and careers in the fields of planning, landscape architecture, natural resource management, and other environmentally related areas such as business, education, and law.

Prerequisites for Entry into the Environmental Studies Program

The wide range of opportunities available to students who enter the ES program, requires that they prepare themselves with a broad range of lower division coursework. The accompanying table of lower division requirements summarizes preparation for entering the ES program. The various requirements provide a sound basis for successful engagement of the environmental studies curriculum at the upper division, for any of the four program study areas.

Prospective ES students are strongly advised to review ES program literature describing the four study areas, so that their study area selection is made on an informed basis. The role of the study area within each student's program is summarized in the accompanying table of upper division re-

Lower Division Coursework[1]

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
A. Natural Sciences	15-20
Coursework must include: General Biology[2] (6-8) (or General Botany and General Zoology), General Geology/Earth Science ((3-4), General Chemistry or General Physics[3] (6-8).	
B. Social Sciences	18
Coursework must include: Economics (3), Government/Political Science (3), Sociology/Cultural Anthropology (3), History (United States) (3), additional coursework, including Psychology, Human Geography, or courses in above subjects (6).	
C. Humanities	6
Courses in Literature, Philosophy, Foreign Language, Art, Music, Drama and related subjects.	
D. Written Communications[4]	6
E. Mathematics and Computer Applications	6
Coursework must include: College-level Trigonometry, Pre-Calculus, or Calculus (3), Computer Applications (3).	
F. Additional Coursework[5]	4-9
Total minimum lower division credits	60

[1]Prior to enrollment into the program, the student must have completed at least 54 of the 60 required lower division credit hours.

[2]At least two courses with labs are required.

[3]Two courses in general chemistry or general physics, or one course in each will satisfy this requirement.

[4]Courses aimed primarily at improving writing skills are intended; these generally do not include literature courses.

[5]Depending on student interests, an additional course in American government or in either general chemistry or general physics, whichever has not been taken to meet the natural sciences requirements, is recommended.

quirements, and each of the study areas provides a distinctive orientation to environmental study, as follows:

Information and technology is designed for students interested in learning about sources of environmental information, and about measurement and technologies applied to the solution of environmental problems. Work in this study area is supported primarily by the Faculty of Forest Engineering.

Land use planning is concerned with the orderly, efficient, equitable, and aesthetic development of land with special concern for the state of the natural environment and the development, interpretation, and administration of land use plans and regulations. This study area is supported mainly by the Faculty of Landscape Architecture.

Biological science applications is designed for students interested in environmental careers requiring a solid understanding of biological sciences pertinent to our natural resources, providing additional social science background for applying biological knowledge to problems of societal importance. Work in this area is supported principally by the Faculty of Environmental and Forest Biology.

Policy and management is concerned with the basic principles, values, and techniques of natural resources and environmental management, including an understanding of the public policies and programs that underscore these concerns. The need to integrate diverse social, institutional, political, legal, and biophysical considerations inherent in attaining environmental objectives is emphasized. This study area is supported mainly by the Faculty of Forestry.

Students seeking admission into the ES program should note particularly that identification of choice of study area is required as a condition of final acceptance into the program. This allows students to begin study area coursework in the first semester of the junior year.

Upper Division Courses

Credit Hours

A. ESF 332, Seminar for New Transfer Students 0

B. Foundations of Environmental Studies 21-22
Coursework is intended to provide a balanced exposure to the range of natural and human aspects of environmental study. The foundation includes 12-13 credit hours of natural science, including FOR 345 Soils, FOR 341 Hydrology and Water Quality, EFB 320 General Ecology, and one course from the following selection: EFB 303 Introduction to Environmental Microbiology, EFB 326 Diversity of Plants, or EFB 483 Biology of Birds and Mammals. The foundation also includes 9 credit hours of social science coursework, including EST 496 (Section) Attitudes, Values, and Environment, EST 321 Government and Environment, and EST 496 (Section) Environmental Alternatives, or acceptable alternatives to these social science courses.

C. Skills and Methods 13
Coursework is intended to provide grounding in technical communications and technical methods. The technical communications requirements for 4 credit hours and includes CMN 410 Writing for Professionals, and LIB 300 Library Research. Technical Skills and Methods require 9 credit hours including 3 credits of statistics, 3 credits of other methods, including CMN 531 Environmental Communications, FOR 550 Environmental Impact: Principles and Strategies, APM 360 Introduction to Computer Programming, or an acceptable alternative, and 3 credits of a special method which is described for the student's area of study.

D. Areas of Study 12
Coursework selections for an area of study provide focus for the student's environmental studies program, and commence in the junior year of study. Study areas are: information and technology, land use planning, biological science applications, and policy and management. A 12 credit hour core of study is provided for each. For information and technology, the core is: EST 496 (Section) Environmental Measurements, EST 496 (Section) Environmental Technology I, EST 496 (Section) Environmental Technology II, and EST 496 (Section) Introduction to Geographic Information Systems. For Land Use Planning, the core is: EIN 311 Natural Processes in Planning and Design, EIN 451 Community Land Use Planning, EIN 496 Land Use Development Process, and LPP 456 Land Development Law. Core courses for the biological science applications area of study include 6 credits of biological resource courses, from which will be selected 3 credits of plant resources and 3 credits of animal resources coursework. Further coursework of 6 credit hours is selected from an extensive list of biological science course alternatives. For policy and management, the core is: FOR 307 Environmental Economics, FOR 360 Principles

of Management, FOR 496 Environmental and Resources Policy, and FOR 587 Environmental Law.

E. Additional Courses 12
This coursework provides students with an opportunity for additional educational breadth and depth in environmental studies. In this category, students complete 6 credit hours of additional study area courses on topics that lie within the scope for the chosen study area. A list of specific options is provided except in the biological science applications study area, in which students are required to complete one course in each of two other areas of study. An additional 6 credit hours are designated as free electives.

F. Senior Synthesis 3
Students are required to complete 3 credit hours of coursework during their senior year that synthesizes their environmental studies education. This is accomplished through appropriate course selection following the advice of the academic advisor, and may at times be in the form of a small group seminar or internship.

Total minimum upper division credits......61-62

A total of 121-122 credit hours is required to complete the environmental studies curriculum. Normally up to 60 credit hours taken prior to matriculation at the College of Environmental Science and Forestry will be accepted as advanced standing credits. A minimum of 51 upper division credit hours must be completed to be considered for graduation.

Graduate Program in Environmental Science

The graduate program in environmental science (GPES) offers M.S. and Ph.D. degrees. GPES was created in the early 1970s as a unique response to the emerging institutional and analytical challenges of developing environmental problems. The program, which draws upon faculty from across the College, emphasizes a multidisciplinary social and natural science approach to environmental understanding and stewardship. It maintains a strong academic orientation, facilitating student and faculty engagement of fundamental environmental challenges such as federalism, participatory democracy, the uses and limits of scientific prediction, risk, and sustainability.

The mission of GPES is to provide interdisciplinary education, research, and public service to foster effective environmental management and to prepare students to comprehensively address environmental concerns and problems. The program provides for the following:

1. *Multidisciplinary approach:* recognition of the necessity to approach environmental problems with input from several disciplines and professions;
2. *Holistic perspective:* awareness of and deference to the interdependence of elements within broadly defined ecosystems, including physical, biological, social, and economic systems;
3. *Topical grounding:* competency to understand and apply the principles of a particular subject of environmental inquiry in sufficient depth to interact with other disciplines and professional fields;
4. *Realistic experience:* through internships, focused projects, theses and seminars which provide for direct interaction of legal, economic, political, and social systems which underlie decision-making.

Environmental management utilizes available social and technical resources to protect the natural resource base and to meet the needs of society.

Central to effective environmental management is the study of public policy, how it is formulated and implemented. Policy formulated on the basis of contemporary scientific knowledge together with societal, economic, and cultural values, pave the way for effective environmental management through the application of engineering and science; and, policy planning, regulation, and program administration.

Starting with students who have an undergraduate background in an established discipline or profession (e.g., chemistry, biology, engineering, ecology, or forestry), the program seeks to build upon existing strengths broadening the student's ability to deal effectively with the complex, interdisciplinary problems which arise in environmental studies.

GPES's internal structure incorporates a common core which provides a broad policy-oriented foundation for the focused areas of study. Students applying to GPES must select which area of study they intend to pursue.

Requirements

The academic requirements of the graduate program in environmental science are designed to provide graduates with a sound preparation to meet the rapidly evolving challenges of the field as

leading scholars and professionals. Programmatic requirements constitute a framework which includes: (1) a comprehensive core foundation emphasizing theory, issues, and methods; (2) extended knowledge within an area of study; and (3) a synthesis experience.

Entering students should be adequately prepared to engage graduate level work in the program. The following undergraduate courses are required pre- or co-requisites for all students: statistics, ecology, and micro-economics or environmental economics. Courses in political science are strongly recommended.

In addition, students should have an academic background and/or work experience related to the selected area of study. Wherever possible, deficiencies should be made up prior to matriculation.

Master of Science

The master's degree is designed as a two-year experience.

1. Core
   a. A total of 15 credit hours is required with the following distribution: 9 credit hours chosen from (i) institutions, government and the environment; (ii) environmental history, values and society; and (iii) environmental policy analysis and decision-making; 3 credit hours in quantitative meth ods; and 3 credit hours in advanced environmental policy as determined by the study area faculty.
   b. An additional nine credit hours total in the following subjects as determined by the studyarea faculty are also required: institutions, government and the environment; environmental history, values and society; environmental policy analysis and decision-making;

2. Area of Study
   A minimum of 15 credit hours (excluding 898 and 899 courses) in the area of study, as determined by the major professor and area of study faculty.

3. Synthesis
   The student may choose between two alternatives:
   a. Thesis or project: a minimum of six credit hours of research resulting in a document that clearly demonstrates graduate level accomplishments of the student, followed by a defense examination; minimum total credits for degree is 36.
   b. Professional experience:
      i. a minimum of 12 additional credit hours of coursework including six credit hours in an internship with a public or private organization, followed by a comprehensive examination; minimum total credits is 42.
      ii. concurrent degree law students in this option complete a six credit hour internship followed by a comprehensive exam; minimum total credits is 36.

Doctor of Philosophy

The Ph.D. program provides a unique opportunity to develop environmental policy related research within a strong College community of environmental analysts, and to draw upon the expertise of scholars at Syracuse University. All applicants are expected to have completed a master's research thesis. A copy of the thesis abstract should accompany the application. In addition, entering students are required to complete the equivalent of the GPES masters' core either from prior graduate study or coursework taken within the first year of residency.

Areas of Study

Environmental Land Planning

Participating Faculty: FELLEMAN, GRATZER, LEWIS, PALMER, SANDERS

Land planning is a continuous process that guides decision-making related to the location and functional character of human activities. Planning involves the description and analysis of biophysical and socio-economic systems; the development and application of methods to generate and evaluate alternative future scenarios; and the synthesis of a variety of regulatory and economic implementation strategies. Sophisticated information systems are used to monitor dynamic change and facilitate multiple parties including private sector firms, local, state, and federal agencies, and a spectrum of interest groups. These parties often have differing goals and values which need to be reconciled.

Planning is essentially concerned with the future. Its activities address short term transactional guidance such as permit systems, mid-range tactical decisions such as facility siting, and long range strategic analysis such as comprehensive plans and legislative enactment. Our ability to understand the future is based on knowledge gained from the critical study of history, and case studies

of current practice.

Environmental Modeling and Risk Analysis

Participating Faculty: HALL, J. M. HASSETT, J. P. HASSETT, HERRINGTON, NAKATSUGAWA, TOLL

The environmental modeling and risk analysis study area focuses on problems in environmental and natural resource policy in which technical issues are of central importance. The program is designed for graduate students with a science or engineering background. Current research includes: spatial model construction, ecosystems modeling, development of model assessment and selection criteria, environmental risk assessment, use of technical information by regulatory agencies, land use forecasting for public policy decision-making, and water resources assessment and planning. The environmental modeling and risk assessment area of study provides a unique opportunity to study interdisciplinary problems. Specific coursework in environmental modeling and risk assessment is supplemented by traditional disciplinary coursework in engineering or the natural sciences and policy analysis.

Environmental Policy and Democratic Processes

Participating Faculty: DALL, HENNIGAN, HORN, PALMER, M. SHANNON, SMARDON, TOLL

Environmental policy studies are designed to achieve a systematic, interdisciplinary understanding of public decisions for environmental protection and resources management. Essential subjects include the institutional setting and processes in which environmental policy is established and operates, the social forces which support the system, and techniques for the evaluation of policy decisions and their outcomes.

Environmental policy refers to decisions intended to achieve environmental quality goals. Analysis of environmental policy generally includes the examination of alternative goals and alternative means for their achievement. Various techniques of policy science are employed in analysis. Environmental policy studies also includes the system actors, participants, institutions and processes which set the agenda and provide for the adoption, implementation, and evaluation of policies.

Water Resources Management

Participating Faculty: BLACK, BOYER, J. M. HASSETT, J. P HASSETT, HENNIGAN, MCCLIMANS, SMARDON

The water resources management area of study develops an understanding of technical, social and institutional aspects of water resources management. Individual students may emphasize scientific or social subject areas but all study in both areas. Scientific aspects include the basic physical, chemical, and biological interactions occurring in water resource systems. The social aspects are concerned with planning, regulation, law and institutions, and management of water resources. Water serves as a focus for graduate study in water and related land resources management, and water pollution and water quality control.

Recommended coursework includes: (1) physical sciences: civil engineering, geology, geomorphology, hydrology, meteorology, environmental engineering, soils, water chemistry, hydrogeology hydrogeochemistry, and geographic information systems; (2) biological sciences: ecology, entomology, fishery biology, forestry, microbiology, water quality, and limnology. (3) social sciences: administration, economics, government, history, law, ethics, philosophy and policy.

The Faculty of Forest Engineering

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BROCK (Photogrammetric and Geodetic Engineering, Geo-spatial Information Systems), DUGGIN (Image Analysis, Remote Sensing, Atmospheric Modeling, Physics), HASSETT (Environmental Engineering, Water Resources), HOPKINS (Surveying, Geo-spatial Information Systems, Remote Sensing), LEE (Computers and Systems Engineering, Transportation and Equipment, Soil Mechanics), MCCLIMANS (Soils, Hydrology, Site Engineering), D. PALMER (Engineering Economics, Energy, Production and Harvesting Systems), TOLL (Environmental Monitoring, Risk Assessment, Environmental Policy), TULLY (Structures, Engineering Hydrology, Water Resources).

A large portion of our nation's resources exists on forested and rural lands. These include: the increasingly valued renewable resources of timber, biomass and wildlife; the sustaining resources of water, soil and nutrients; and the derivative resources of paper, wood, and fibrous products and recreation and amenity values. Forest engineering is a unique field of engineering which is concerned with the design of systems and facilities to improve the sustained high quality yield of resources and multiple use benefits of goods and services from forested and rural lands.

The undergraduate curriculum in forest engineering provides a broad base of study and specialized education in engineering with an emphasis on site development for improved resource use and conservation. Instruction focuses on: locating and quantifying resources; designing harvesting, conveyance and transportation systems and networks for water and timber; designing structures, facilities and pollution abatement systems; and engineering planning for the development of sites and regions for multiple use.

The special importance of continual measurement and evaluation of the broad scaled parameters which affect the resource base, provides unique opportunities for study to students aiming toward professional careers involving the conceptualization, design, and maintenance of geographically referenced resource information systems. This includes elements of surveying, photogrammetry, remote sensing, and resource information systems design.

Lower Division Courses

Students entering this program through the freshman admissions option should refer to page 55.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
Biology	3
General Chemistry with Laboratory	8
Engineering Physics with Laboratory	8
Calculus through Differential Equations	15
English	6
Economics (Macro and Microeconomics)	6
Engineering Drawing (Graphics)	1
Computer Programming	3
Engineering Mechanics (Statics and Dynamics)	5
Electrical Science	3
Humanities or Social Science Electives	3
Total minimum lower division credits	61

Undergraduate Program

The primary objective of this degree program is to prepare qualified engineering graduates to operate with professional competence within the context of forest and natural resources development. The curriculum includes basic, forest, and engineering sciences. It utilizes elements of traditional engineering disciplines and develops its unique aspects from interweaving engineering design with an understanding of the natural environment and its renewable resource base including water, soil, timber, wildlife, and amenity values. Studies in the humanities and social and economic sciences are integrated throughout the curriculum to help achieve a broad and balanced perspective of professional practice in forest engineering.

Forest engineering students with an interest in graduate study can plan their undergraduate studies along an individualized track which will prepare them for entry into a master of science program in environmental and resource engineering at ESF. In this way, forest engineering students who qualify will be admitted to a quality graduate program with minimal inconvenience or interruption in their studies.

Upper Division Courses

Junior Year

			Credit Hours
First Semester	ESF 332	Seminar for New Transfer Students	0
	ERE 362	Mechanics of Materials	3
	ERE 371	Surveying for Engineers	3
	FOR 321	General Silviculture	3
	CIE 327	Principles of Fluid Mechanics	4
	EFB 335	Dendrology	2
	Elective		3
			18
Second Semester	FEG 340	Engineering Hydrology and Flow Controls	4
	FEG 350	Introduction to Remote Sensing	2
	FEG 363	Photogrammetry I	3
	MEE 285	Introduction to Computers in Design	3
	APM 395	Probability and Statistics for Engineers	3
	ERE 351	Basic Engineering Thermodynamics	2
			17

Senior Year

			Credit Hours
First Semester	FEG 410	Structure I	4
	FEG 420	Harvest Systems Analysis	1
	FEG 430	Engineering Decision Analysis	3
	CIE 337	Soil Mechanics and Foundations I	3
	FOR 477	Resource Policy and Management	3
	Elective		3
			17
Second Semester	FEG 454	Power Systems	2
	FEG 437	Transportation System	3
	ERE 440	Water Pollution Engineering	3
	FEG 489	Forest Engineering Planning and Design	3
	Elective in Engineering Design Sequence		3
	Elective		3
			17
	Total minimum upper division credits		69

A total of 130 credit hours is required to complete the B.S. degree in forest engineering.

In addition, qualified graduates in search of advanced degree education enjoy ready acceptance to engineering graduate schools throughout the country. Graduates of the forest engineering curriculum may enter a five-year program in either civil, or mechanical engineering at Syracuse University. A bachelor of science degree in engineering will be awarded by Syracuse University upon completion of the requirements of the fifth year.

To enter the forest engineering curriculum at the junior level, a transferring student must have acceptable college credit in the designated coursework areas or be able to have suitable coursework substitutions for courses listed in the junior and senior years.

The curriculum in forest engineering is accredited by the Engineering Accreditation Commission/Accreditation Board for Engineering and Technology (EAC/ABET).

Lower and Upper Division Elective Requirements for Those Entering Through the Freshman Residency Program

For those students entering the sciences and engineering track in the freshman residency program with the intention of pursuing the upper division program in forest engineering, the following guidelines should be considered when planning their program:

Humanities or social sciences: electives taken throughout the full four-year curricula must include at least nine credit hours in social sciences or humanities, at least three of which are recommended to be upper division. Humanities coursework deals with branches of knowledge concerned with man and his culture, while social sciences coursework concerns individual relationships in and to society. Traditional subjects in these areas are philosophy, religion, history, literature, fine arts, sociology, psychology, anthropology, economics, and modern languages beyond the introductory skills courses, while modern nontraditional subjects are exemplified by courses such as technology and human affairs, history of technology, and professional ethics and social responsibility. Subjects such as accounting, industrial management, finance, personnel administration, ROTC studies, and skills courses, such as public speaking and technical report writing, do not fulfill the humanities and social science content.

Students having advanced placement credits are encouraged to work closely with their advisor in order to best prepare for various upper division elective sequences in technology, science, design or management.

Engineering design: At least three credit hours are required in upper division engineering coursework as part of an advisor approved sequence which complements other forest engineering coursework and provides the equivalent of at least one credit hour of depth in the design and synthesis component of the program, such as:

Structures II
Soil Mechanics II
Air Pollution Engineering
Photogrammetry II
Synthesis of Mechanical Systems
Advanced Topics in Hydraulics

Graduate Opportunities

Through the program in environmental and resource engineering, the faculty participates in graduate education leading to the master of science and doctor of philosophy degrees.

Graduate studies and research are primarily concerned with environmental and resource related programs. Successful and individual programs of graduate study may be efficiently designed by students with bachelor of science degrees in engineering or in forestry, natural sciences, physics, or mathematics.

See page 57 for more information on graduate study in environmental and resource engineering.

Support for graduate study and research in these areas is both internal and external. The internal support includes modern laboratory and instrumentation facilities in the engineering faculties at both ESF and in the Engineering School at Syracuse University. Exceptional support exists for programs in environmental engineering measurements in the form of remote sensing and photogrammetric laboratories and the extensive forest properties owned by the College at which research may be conducted.

External support comes from several active sources, including industrial, commercial and governmental. Over the past two decades, close cooperation has developed special study and research opportunities with these sources.

The Faculty of Forestry

BOB G. BLACKMON, Chair
107 Marshall Hall
(315) 470-6536/6535

BOB G. BLACKMON, Professor and Chair (Soils, Forestry Education)

Syracuse Campus

ABRAHAMSON (Entomology, Pathology, Pesticides), ANDERSON (Forest Management), BENNETT (Economic Theory, Economic Thought in Forestry), BLACK (Water and Related Land Resources), CANHAM (Forestry Economics, Regional Economics, Natural Resource Economics), COUFAL (Silviculture, Environmental Ethics, Forest Education), CRAUL (Forest and Urban Soils), CUNIA (Operations Research, Biometry), DAVIS (Forest Management, Timber Harvesting), DAWSON (Tourism Planning, Commercial Recreation), DREW (Tree Physiology, Forest Autecology), ESCHNER (Forest Influences, Forest Hydrology), GRATZER (Forest Recreation, Forest Management), HERRINGTON (Forest Management Computers, Micrometeorology), HORN (Forest Management, Law), HOWARD (Silvics, Forest Management), KOTEN (Forest Management, Management Science and Planning), MAYNARD (Tree Improvement), MONTEITH (Forestry Economics, Land Use, Continuing Education), MORRISON (Forest Recreation), NYLAND (Silviculture, Forestry Practice), PETRICEKS (Resource Economics, International Forestry Economics), RICHARDS (Silviculture, Urban Forestry), SHANNON (Forest Policy, Forest Resources Sociology), STEHMAN (Statistics), WHITE (Forest Soils, Silviculture).

Ranger School, Wanakena Campus

MILLER (Roads, Installations, Timber Harvesting), O'NEILL (Ecology, Forest Management, Forest Protection), REMELE (Dendrology, Aerial Photogrammetry, Silviculture), WESTBROOK (Surveying, Personnel Management, Soil).

Adjunct Faculty: CASTRO (Social Forestry, International Forestry), FINGER (Environmental Communication and Politics), HORSLEY (Silvics), MARQUIS (Silviculture), NEUHAUSER (Environmental Science and Renewable Resources), ROWNTREE (Urban Forestry), SLOAN (Policy), STITELER (Statistics), TABER (Extension Programs), YAWNEY (Silviculture), ZIPPERER (Urban Forestry).

The educational program in the Faculty of Forestry leading to the first professional degree (bachelor of science) in forestry, is accredited by the Society of American Foresters (SAF). SAF is a specialized accrediting body recognized by the Council on Postsecondary Accreditation and by the U.S. Department of Education as the accrediting body for forestry in the United States.

Mission

The Faculty of Forestry, one of the nation's major forestry programs, shares with companion forestry schools a search for truth and excellence through the scholarly endeavors of instruction, research, and public service. The Faculty of Forestry seeks to enlarge the body of knowledge in forestry and natural resources and to share that knowledge with society. The Faculty strives to provide quality educational opportunities which encourage students to think critically, synthesize knowledge, communicate effectively, and utilize technology responsibly. The Faculty of Forestry serves a worldwide clientele, and thus has a major responsibility for educating students to function effectively in their own and in other cultures.

Programs of the Faculty of Forestry are designed to assist society in the development, protection, and management of forest resources of the state, region, nation, and the world. The mission encompasses the forest's commodity and social values such as wood, water, recreation, wilderness, and aesthetic beauty. Implicit in the mission is the dynamic interrelationship between forests and the human population.

To carry out the mission of the Faculty of Forestry, several educational programs are offered: associate of applied science, bachelor of science, master of science, master of forestry, and doctor of philosophy. In addition, the Faculty contributes to the body of knowledge through an active research program, and extends information to appropriate clientele through public service activities and a program of continuing education.

Support Goals

1. To provide opportunity for education at the associate degree level in forest technology to prepare graduates for careers as forestry and natural resource technicians in private and public sectors, or as preparation for pursuit of baccalaureate education.
2. To provide opportunity for undergraduate, collegiate-level education in resources management that prepares graduates to assume positions in industry, public agencies and consult ing firms, at the entry level but with sufficient breadth and depth of education to allow them to assume increasing responsibility to at least the middle management level.
3. To prepare undergraduates for pursuit of graduate education at any of the world's graduate programs in forestry, natural resources, environmental science, or related disciplines.
4. To provide opportunities for graduate study at the master's level through a master of forestry program which enables graduates to pursue careers in operations and management of forest resources at the middle management level and beyond.
5. To provide opportunities for graduate study at the master's level through the master of science degree leading to employment in forestry and natural resource management and/or preparation for further study at the doctoral level.
6. To provide opportunities for advanced graduate study through the Ph.D. program, providing graduates with the technical, scientific and professional base to become leaders in forestry and related natural resource professions through employment in research, higher education, and managerial positions.
7. To provide students in the environmental studies program (policy and management study area) with the educational background to understand the concepts and skills pertinent to dealing with environmental policies and management of environmental programs, and to support other interdisciplinary programs in the Faculty of Forestry and across the College.
8. To maintain and enhance world-class research programs that add to the body of knowledge and, through publication of research results, contribute to state, regional, national, and worldwide informational needs of the forestry community.
9. To maintain a program of continuing education that extends knowledge through workshops, seminars, symposia, and publications.
10. To contribute to the total educational program of the College by offering service instruction at both undergraduate and graduate levels.
11. To provide an atmosphere that fosters an appreciation for the liberal arts and humanities and an understanding of the relationship between these disciplines and the biophysical sciences.
12. To instill in students a sense of community based on common goals, values, and expectations, and to provide them with an environment that fosters both individual creativity and an appreciation for the cooperative spirit.
13. To address through undergraduate and graduate instruction, research, and public service the complexities of the socioeconomic and political environment in which modern resource management is practiced.
14. To provide an atmosphere which fosters a positive learning and working environment for women and members of underrepresented groups, and to be proactive in recruiting them into the Faculty of Forestry.

Undergraduate Program in Resources Management (General Forestry)

Professional forestry consists of a blend of environmental, social, economic, and biophysical disciplines as they relate to natural resources, and the ESF setting is ideal for teaching the interaction of these subjects. Syracuse is located in the center of the country's second most populous state. Urbanization and development in certain parts of New York and the Northeast are increasingly creating important land-use issues and conflicts. At the opposite end of the land use spectrum, wilderness is also very much present in New York. Within an easy drive of the campus lies the six-million-acre Adirondack Park, the oldest and largest wilderness area east of the Rockies. The park is only a few hours from New York City and other heavily populated areas. In fact, New York State's forests are located within a day's drive of almost one-third of the U.S. population.

Recreation accounts for another key use of New York's forests. The many ways in which people enjoy the forests–whether as campers, hikers, skiers, vacationers on mountain lakes–have many outlets within the state. From the Catskill Park north of New York City, to the Allegany State Park in the southwest corner of the state, to the Adirondack Park, this and other intense public uses of the forest give the Faculty of Forestry the opportunity to teach students the various alternatives for dealing with the many issues that develop as modern

society continues to interface with the forest.

In addition, there are approximately 500,000 private forest land owners in the state, many of whom are deriving financial return from their forests. The forest products industry is a vigorous part of the New York economy, employing 88,000 people and accounting for a payroll of about $1.1 billion each year. The Faculty of Forestry recognizes the economic as well as social benefits of the forest, and strives to give its students an understanding of forest management that is both financially and environmentally sound. Many private forests are located near Syracuse and are used in teaching.

In essence, forestry is a broad academic endeavor. Education about the forest itself is founded in basic biophysical subjects such as biology, chemistry, physics, and mathematics. But as we approach the 21st century, forestry has become much more than the forest. Thus, in addition to the biophysical subjects and basic forestry, students are given an appropriate mix of social and environmental sciences, and communications. The result, we believe, is a graduate who can effectively deal with land and resource issues in a complex and ever-changing society. The Faculty of Forestry offers three undergraduate degree programs designed for students planning different career paths:

1. A professional forestry and natural resources management degree program, leading to a bachelor of science degree, offered at the Syracuse campus. A minor in management, using courses from Syracuse University's School of Management, is available within this program. It enables students to acquire specific additional managerial skills (see page 93 for details).
2. A dual major program, leading to a bachelor of science degree, that meets the requirements of both the forestry and the environmental and forest biology degree programs. For details, see page 63.
3. A forest technology degree program, leading to the associate's degree, offered at the Ranger School campus. For details, see page 94. It is possible to transfer from this program to the bachelor degree programs, as explained on page 95.

The professional forestry and resource management program prepares students to manage forests and related resources for human benefit, while protecting and enhancing the environment. Through a carefully designed sequence of required courses and electives, students learn the principles and applications of forest ecology, techniques of forest measurement, and the principles of economic and managerial policy and administration. Electives allow students to concentrate their study in special areas of forestry or to broaden their education to fulfill personal or professional needs.

A seven-week summer field session at ESF's Wanakena Campus is the starting point of the program. This session emphasizes field skills and techniques, and introduces basic ecological and managerial concepts. *The summer session is required prior to registration for the junior year.*

The summer field session is followed by a highly integrated semester which includes an introduction to the physical environment (soils, and forest influences, which covers meteorology and hydrology), study of physical and biological influences on tree growth and development (silvics), and the manipulation of the ecosystem which can be made to take advantage of these responses (silviculture).

Electives comprise about one-fourth of the curriculum and allow students to shape their programs to meet their individual needs and interests. For example, one student might distribute electives among all areas of forestry's multiple uses, while another might concentrate them in areas such as watersheds, forest wildlife, recreation, entomology, pathology, soils, international forestry, or urban forestry. Electives may be taken at ESF and Syracuse University. SU electives include such areas as anthropology, geography, business management, and communications. Careful use of electives allows the student to tailor his or her educational experience to a social emphasis such as outdoor recreation or urban forestry, to an economic/financial/management emphasis through a minor in Syracuse University's School of Management, or to a strong biological and environmental science emphasis.

Elective courses are selected with the assistance of a faculty advisor, and should be planned early in the student's course of study. The student may elect to pursue a variety of independent or group study activities. These may be conducted in whole or in part at any one of the College's several campuses, off campus at another institution, or in cooperation with some resource management agency or firm. Proposals for off-campus study are subject to faculty review and approval and are carried out with faculty guidance to ensure adherence to academic standards.

A total of 135 credit hours is required to complete the B.S. program. Students contemplating entering it should have completed at least 62 semester credit hours or have earned an associate degree; further, a minimum of 56 of these credit hours must be distributed among specific course

Lower Division Courses

Students entering this program through the freshman admissions option should refer to page 56.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
Biology (Botany and Zoology preferred)	8
General Chemistry with Laboratory	8
Physics I with Laboratory	4
Calculus I	3
Economics (Microeconomics required)	3
Political Science (U.S. Institutions)	3
Introductory Sociology or Introductory Psychology	3
Computer Applications	3
English[1]	6
Electives[2]	21
Total minimum lower division credits	62

Upper Division Courses

Summer Program in Field Forestry[3]

		Credit Hours
FOR 301	Field Dendrology	1.0
FOR 302	Forest Surveying and Cartography	2.5
FOR 303	Introduction to Forest Mensuration	3.5
FOR 304	Introduction to Forestry	1.0
		8.0

Junior Year

			Credit Hours
Fall Semester	ESF 332	Seminar for New Transfer Students	0
	FOR 305	Forestry Concepts and Applications	1
	FOR 322	Forest Mensuration	1
	FOR 331	Forest Influences	3
	FOR 332	Silvics	3
	FOR 333	Silvics Laboratory/Practicum	1
	FOR 334	Silviculture	4
	FOR 345	Soils	3
	ESF 332	Seminar: Orientation	0
			17
Spring Semester	FOR 360	Principles of Management	3
	FOR 363	Management Models	3
	APM 391	Introduction to Probability and Statistics	3
	Electives[2]		6
			15

areas as outlined on page 92. Students who have completed more than 64 lower-division credits may transfer up to 12 additional hours of junior-senior level courses and should seek advice on upper division credits at the time of matriculation. The professional forester must understand both the biological and social influences that affect forest resources. Prospective students should thus choose lower-division electives to broaden and enhance their communication skills and their understanding of social and political sciences and humanities.

Minor in Management

The resources management program, as described above, contains a core of knowledge of both resources and management sciences sufficient for the practice of forestry and related resources management. Students use electives to shape programs that meet their career objectives.

Using some of these electives, the minor in management provides a formal, focused opportunity to expand and broaden managerial skills, and is recognized via appropriate notation on the student's official transcript.

Using a part of the 26 credit hours of upper-division electives, the minor in management requires completion of five courses from the Syracuse University School of Management. Three of these courses are required, covering the legal system, money and banking, and marketing and society. The other two courses are selected from among lists of recommended and acceptable courses, with topics ranging from organizational behavior to labor relations, from corporate finance and operations management to real estate. Along with microeconomics and statistics, both part of the resources management degree program, students wishing to pursue a minor in management must take accounting as prerequisite to the minor, and are advised to take it as one of the lower-division electives.

Students must declare their intent to undertake the minor in management early in the fall semester of the junior year, using an application approved by the student's advisor and the Faculty of Forestry Undergraduate Education Coordinator. A G.P.A. of 2.500 in lower division coursework is required for admission.

Senior Year

			Credit Hours
Fall Semester	FOR 400	Forest and Resource Economics	3
	FOR 470	Management of the Forest Enterprise	3
	APM 492	Forest Biometrics	3
	Electives[2]		6
			15
Spring Semester	FOR 465	Natural Resource and Environmental Policy	3
	Electives[2]		15
			18
	Total minimum upper division credits		73

A total of 135 credit hours is required to complete the B.S. degree in resources management—general forestry.

[1]Standard freshman English sequences are acceptable, but where possible the student is strongly urged to take technical report writing.

[2]Electives taken throughout the full four-year curriculum must include at least 9 credit hours of social sciences, such as anthropology, economics, geography, history, political science, sociology, and psychology; 9 credit hours of humanities, such as art, music, language, philosophy, and literature; 9 credit hours dealing specifically with at least two major resources (forage, minerals, recreation/amenities, water, wildlife, or wood); and another 3 credit hours in the area of forest protection (entomology, pathology, or fire). Of the total electives in the four-year curriculum, at least six must be taken in two or more of the Faculties at ESF other than Forestry.

[3]Summer program in field forestry consisting of seven weeks, eight credit hours, is required of all students (except forest technology graduates and students from Morrisville Agricultural and Technical College, and others who have completed a specific sequence of courses with the approval of their pre-ESF advisor prior to registration for the junior year. Other two-year programs will be evaluated on a case-by-case basis.)

Curriculum for Combined Forest Technology and Resource Management Programs*

Freshman Year	Credit Hours
(Completed at a college of the student's choice)	
Biology (Botany and Zoology preferred), with Laboratory	8
English (A technical report writing course is highly recommended.)	6
Calculus I	3
Microeconomics	3
General Chemistry, with Laboratory	4
Physics I, with Laboratory	4
Political Science (U.S. Institutions), or Introductory Sociology, or Psychology, or Computer Application	3
Minimum total credits, freshman year	31

Sophomore Year (Wanakena Campus)	Credit Hours
FTC 200 Dendrology I	2
FTC 202, 203 Plane Surveying I and II	5
FTC 204, 205 Forest Mensuration and Statistics I and II	5.5
FTC 206 Forest Ecology	3
FTC 207 Aerial Photogrammetry	3
FTC 208 Allied Technologies	3
FTC 209 Forest Roads	2
FTC 211 Silviculture	2.5
FTC 213, 227 Forest Protection I and II	4
FTC 214 Personnel Management	1.5
FTC 215 Timber Harvesting	2
FTC 217 Forest Management	3.5
FTC 218 Forest Recreation	1.5
FTC 219 Elements of Wildlife Ecology	1.5
FTC 221 Soil and Water Measurements	1.5
FTC 223 Graphics	1
FTC 228 Structure and Growth of Trees	1.5
FTC 229 Silviculture II OR FTC 230 Plane Surveying III	2
Total credits, sophomore year	46

Summer between Ranger School graduation and start of Junior Year

General Chemistry II, with Laboratory	4
Two courses fulfilling requirements for either political science (U.S. Institutions)/introductory sociology/introductory psychology/computer applications; or electives (See footnotes on page 93.)	6
Total credits, summer program	10

Junior Year	Credit Hours
FOR 305 Forestry Concepts and Applications	1
FOR 322 Forest Mensuration	2
FOR 331 Forest Influences	3
FOR 332 Silvics	2
FOR 333 Silvics Laboratory/Practicum	1
FOR 334 Silviculture	4
FOR 345 Soils	3
FOR 360 Principles of Management	3
APM 391 Introduction to Probability and Statistics	3
FOR 363 Management Models	3
Electives**	6
Total credits, junior year	31

Senior Year	Credit Hours
APM 492 Forest Biometrics	3
FOR 400 Forest and Resource Economics	3
FOR 465/665 Natural Resource and Environmental Policy	3
Electives**	20 - 23
Total credits, senior year	29 - 32

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*This model is meant for those students who have the initial intent of attending the forest technology program (Ranger School) and the resources management—general forestry program (Syracuse campus).

**Electives will be used to complete social science, humanities, and professional coursework as indicated in the resources management curriculum.

Transfer from the Ranger School

Given the nature of the Forest Technology Program at Wanakena, students entering from the Ranger School are not required to attend the summer session in field forestry, the 8 credit hour field experience other incoming juniors must attend. Instead, Ranger School transfer students are encouraged to use the summer prior to the junior year to complete the lower division requirements as outlined on page 94. The time spent on completing the bachelor's degree is thus two years for all students, but the configuration of courses differs somewhat between community college and Ranger School graduates.

There are several advantages to combining a Ranger School education with a baccalaureate program at ESF's Syracuse Campus. At the end of two years, Ranger School graduates have had a chance to explore some of the varied facets of forestry, an experience which can prove helpful when choosing electives. In addition, Ranger School graduates have earned an A.A.S. degree in forestry, and those who choose to work for a time before beginning the baccalaureate will have marketable skills. Most importantly, Ranger School graduates who go on to pursue the bachelor's degree have a solid field-oriented technical education as well as a managerial orientation and the deeper ecological and social understanding provided by the professional curriculum.

Graduate Education

The Faculty of Forestry offers two graduate programs: forest resources management, leading to the master of science (M.S.) and doctor of philosophy (Ph.D.), and forest management and operations, leading to the master of forestry (M.F.) degree. The Faculty of Forestry will also award up to eight credit hours for suitable Peace Corps service. Further details are available from the Graduate Studies/Research Coordinator.

Joint study with other SUNY ESF faculties and with Syracuse University is also possible. In a number of areas, particularly environmental and forest biology, programs of study can be established which formally include members of other Faculties of the College. Programs which provide the student with two masters' degrees, one from SUNY ESF and another from Syracuse University, are available with the following SU schools:

- School of Management
- Maxwell School of Citizenship and Public Affairs
- Newhouse School of Communications
- School of Education

The concurrent degree programs usually add an additional year of study to a normal master's program of study. To be eligible, a student must have been matriculated full-time at the College for at least one semester, must have a grade point average of at least 3.500, and must be formally accepted into the concurrent degree program.

Forest Resources Management (M.S., Ph.D.)

Graduate study programs in forest resources management are created to suit the needs of each individual student and are designed to prepare students for careers in resource administration, management, scientific research, professional education, and a variety of other specialized positions related to forest resources management. Students with nonforestry bachelor's or master's degrees and a strong interest in forest resources management are also encouraged to apply.

All candidates for the M.S. and Ph.D. must take two semesters of seminar (FOR 797) for each advanced degree they pursue. Candidates for the Ph.D. must also present a graduate seminar on their respective thesis topic. Additional graduate requirements are set by the College of Environmental Science and Forestry and discussed on pages 33 - 40.

Each graduate student selects (or is assigned) a faculty major professor who acts as the director of the student's study plan. The student and advisor are assisted in planning the program, and in determining successful completion of the program, by at least two other faculty members, who serve as the student's steering committee.

All three of the College's master of science program alternatives (thesis, professional experience, or coursework) are available to master's degree students in the forest resources management program. Students select the appropriate alternative in consultation with their committee. The master's degree usually takes two years of study.

Doctoral study is normally built upon a master's degree, but in some instances it can be undertaken directly after a baccalaureate degree. Doctoral programs usually involve 30 credit hours of formal coursework beyond that required for the master's degree. Written and oral candidacy examinations, intended to test the student's mastery of subject matter essential to the thesis topic, are required, as is an oral defense of the thesis.

Areas of Study

Thirteen areas of study in the forest resources management program are described below, highlighting examples of current faculty and student interest and activity. These examples do not indicate the full range of faculty interest. Similarly, these examples are meant only as highlights;many students have programs encompassing two or more areas of study.

Policy and Administration

Participating Faculty: BLACK, HORN, SHANNON

- Policy issues and analysis
- Administrative organization and management
- Program implementation

Graduate study in the area of policy and administration is designed to prepare students for positions at the planning, budgeting, programming, and operating levels of public agencies and businesses. The expanded regulatory role of federal and state government over resource use and land management has brought substantially increased need for thorough understanding of policy matters, legal requirements, and governmental and political interactions with resource owners and users.

Programs of study include advanced courses, seminars, and special problems structured around these needs and the complex interrelationships of society and resources. Students are encouraged to

round out their academic programs through courses offered by other units of the College and at Syracuse University. Interested students with undergraduate preparation in such areas as forestry, liberal arts, and engineering can be served through the creation of a study program that complements work already taken. The broad array of courses and the diverse points of view available allow the student to build a program to meet specific career objectives.

Forestry Economics

Participating Faculty: BENNETT, CANHAM, MONTEITH, PETRICEKS *(Emeritus)*

- Timber and wood-using industry economics
- Regional economic impacts
- Economics of nonmarket goods

Graduate study in forestry economics prepares students for employment as forest economists or resource analysts with federal and state agencies and with private industry. Graduates with the Ph.D. usually pursue careers in teaching or research. The goals of study in this area are depth of understanding and familiarity with economic tools contributing to making competent decisions in resource economics, management, and policy. Students with undergraduate degrees in forestry or forest products can undertake graduate study in forestry economics. By adding courses in forestry, graduates with liberal arts, engineering, or business degrees can also enter the program.

The core of the student's program consists of courses in forestry and resource economics. In addition, the student must be aware of the social and biological environment in which forestry economics is applied. Thus, the core program is supplemented by courses in general economics, statistics and operations research, resource policy, business administration, and related managerial and biological fields. The program draws on course offerings and facilities of the College and of Syracuse University. Individual programs are tailored to fit the student's particular interest. Some examples are the economics of timber management, land use economics, economics of natural environments, economic development, and forestry.

Forest Management

Participating Faculty: COUFAL, DAVIS, GRATZER, HERRINGTON, HORN, KOTEN, NYLAND, SHANNON

- Resource information systems
- Resource planning and scheduling
- Forest operations
- Timber and multiple-use management

Graduate study in forest management requires a broad knowledge of the natural and societal environments as the basis for understanding how these environments affect (or are affected by) the development and use of forests and associated wild lands. Forest management focuses on the planning and implementation processes necessary to achieve integrated use of forests and associated natural resources. The educational objective is to develop expertise sufficient for capable, professional resource management under a variety of natural and societal environments.

Study programs are flexible, and students may pursue special interests in a single product, several products or services, tools and processes of planning for integrated forest use, or in developing managerial skills. The program's emphasis, however, lies in applying the skills and knowledge to the management of forest lands. Where appropriate, students may take courses at Syracuse University's School of Management and Maxwell School of Citizenship and Public Affairs to complement the College's offerings. Recent graduates have found employment with private and public organizations that own, manage, use, or relate in more indirect ways to forest resources. Students with the doctorate have engaged in research and teaching.

Recreation and Tourism

Participating Faculty: DAWSON, GRATZER, MORRISON

- Commercial recreation and tourism
- Recreation resource planning
- Wilderness and river recreation

Graduate study in this area equips students with a broad understanding of the nature and purpose of outdoor recreation and how it relates to natural resources. The program emphasizes the role of and interrelationships between the public and private sectors in providing recreation and tourism facilities, services, and programs. Individual programs combine study in resources management with relevant studies in the social and political sciences and the development of analytic capabilities needed to implement management plans and programs. Other faculties of the College and within Syracuse University, treating such areas as planning, design, and education, provide a wide range of supporting courses and facilities.

Watershed Management/Hydrology

Participating Faculty: BLACK, ESCHNER *(Emeritus)*, HERRINGTON

- Hydrology
- Snow hydrology
- Soil and water conservation
- Meteorology/micrometeorology
- Water resources policy

Graduate study of watershed management/hydrology, as related to forest influences, includes energy exchange between forest and atmosphere; moderation of urban environments by vegetation; soil and slope stability; and watershed hydrology, including snow. Forest influences include all of the effects resulting from the presence of forest trees and associated vegetation on climate, the hydrologic cycle, erosion, floods, and soil productivity. Health considerations and human comfort, often included in older definitions of forest influences, are assuming even greater importance, given our growing concern for the environment.

Graduates in this area of study fill a variety of positions in research, teaching, and public and private management as watershed management specialists, hydrologists, environmental officers, meteorologists, and ecologists.

Silviculture

Participating Faculty: ABRAHAMSON, COUFAL, HOWARD, NYLAND, RICHARDS, WHITE

- Hardwood silviculture
- Conifer plantations
- Biomass production
- Greenspace silviculture

Graduate study in silviculture stresses the nature of cultural treatments, the theories underlying them, and the biological, physical, and social constraints to their implementation. Silviculturists study stand treatments for their value in producing goods and services and maintaining or enhancing productivity for the future.

Students in silviculture progress, through formal coursework and research, toward an understanding of how cultural treatments affect the balanced, sustained supply of wood, water, wildlife, recreation opportunities, and amenity values. One major area of emphasis relates to treatment of tree stands for their continued production of wood products and other commodities. Another centers on stand treatment for several values simultaneously, where the harmonious integration of uses is of concern. A third focuses on evaluation and manipulation of vegetation systems, primarily for their on-site values, such as recreation areas, highway and utility rights-of-way, and urban greenspace.

Silvics

Participating Faculty: DREW, HOWARD

- Tree physiology
- Forest ecology
- Stand dynamics

Graduate study in silvics examines the scientific basis for the cultural treatment of forest vegetation by studying and defining interrelationships within forest ecosystems and cataloging intraspecific characteristics of tree species. In a sense, silvics is the ecology of managed forest ecosystems, though unmanaged and natural forests are often studied intensively to provide the benchmark conditions from which the silviculturist begins.

The specialist in silvics must work closely with colleagues in the basic disciplines, including soil physics and chemistry, micrometeorology and climatology, genetics and tree breeding, plant ecology and physiology, wildlife biology, entomology, and pathology.

Forest Soil Science

Participating Faculty: CRAUL, WHITE

- Acidic disposition
- Soil physical properties
- Morphology and classification
- Soil chemistry/fertility

Graduate study in forest soil science may be directed toward soil science as it relates to goods and services produced, or to the impact of management practices on environmental quality. Study may include evaluation of ecosystems to quantify nutrient element balances and cycling, amelioration of soils for maintaining increasing ecosystem productivity, and the impact of various land-use practices on soil properties. Other areas may include use of soils information in geographic information systems, ecological land classifications, and the development of expert systems that provide soil use interpretations from remotely sensed data.

Modern, well-equipped laboratories are available for plant, soil, and water chemical analyses; soil physical characterization such as water relations, compaction, aeration, and temperature re-

gimes; and other soil property investigations. The extensive College properties permit forest soil research to be conducted under a wide variety of environments and ecological conditions.

Tree Improvement

Participating Faculty: MAYNARD

- Clonal propagation/tissue culture
- Genetic selection and testing
- Seed orchard management

Graduate study in tree improvement—a field devoted to developing populations of trees that are well adapted, rapid growing, and free of disease involves formal coursework in plant biochemistry and physiology, statistical genetics, and plant breeding. Tree improvement programs are also used to increase the aesthetic or recreational value of forest trees through selection for desirable traits.

Students use modern, well-equipped laboratories and greenhouses, and collect materials and perform field evaluations at many established test plantations. Graduates hold positions in seed orchard management, tree improvement, and forest genetics with private, state, and federal organizations.

International Forestry

Participating Faculty: DREW, GRATZER, PETRICEKS *(Emeritus)*, SHANNON

- All phases of forest resources management

Graduate study in international forestry is designed for individuals who want to pursue internationally oriented careers in forestry and related fields. Instruction is aimed at supplementing and enriching the student's technical forestry knowledge and providing the broad background necessary for service in a variety of professional circumstances: forestry advisor, teacher, or research specialist with national and international agencies, private business and industrial firms, philanthropic foundations, and voluntary service organizations whose activities include the development and use of forest resources in other nations.

At the master's level, students have the opportunity to gain competence in research methods, foreign languages, cultural anthropology, world geography, and international affairs, plus a solid understanding of the world forestry situation. At the doctoral level, the focus is on a specialized discipline area, such as forestry economics, forest policy and administration, forest management, or silviculture.

Syracuse University offers a wide variety of courses supporting the nonforestry elements of this area of study. Qualified candidates may undertake training and research in tropical forestry and related fields.

Urban Forestry

Participating Faculty: CRAUL, HERRINGTON, RICHARDS, SHANNON

- Urban soils
- Urban climate
- Urban forest management/planning
- Urban tree management

Graduate study in urban forestry allows the student to pursue a variety of objectives. Professional urban forestry skills may be enhanced through advanced coursework and applied research; students may also pursue more specialized study in soils, greenspace ecology, atmospheric science, forest science, tree improvement, forest resource inventory and evaluation, resource economics, and planning.

There is strong interaction with other urban-related areas of the College, including remote sensing, botany, pathology, entomology, wildlife ecology, and landscape architecture. Academic departments in Syracuse University's Maxwell School of Citizenship and Public Affairs such as geography, economics, political science, and sociology cooperate with teaching and research programs, as does the U.S. Forest Service Northeastern Forest Experiment Station, Urban Forest Research Project located on the ESF campus.

Quantitative Methods

Participating Faculty: CANHAM, CUNIA, DAVIS, HERRINGTON, HORN, KOTEN, STEHMAN

- Statistics
- Forest inventory/mensuration
- Computer applications/modeling
- Operations research/systems analysis

Graduate study of quantitative methods is designed to develop skills in the application of mathematical, statistical, and computer-based problem analysis and solution. Study in this area is designed primarily for two types of students: those with undergraduate degrees in areas such as the biological sciences, forestry, wildlife, or agriculture, who wish to strengthen their quantitative skills, and those with degrees in mathematics, statistics, or computer science, who wish to focus on resources management.

Students may concentrate in statistics, operations research, biometry, forest mensuration, econometrics, and computer applications development. Syracuse University's computer facilities, for example the Center for Advanced Technology in Computer Applications and Software Engineering (CASE Center), and the University's wide range of courses in mathematics, statistics, and quantitative methods, provide strong support for activities in this area.

Resources Information Management

Participating Faculty: CANHAM, CRAUL, DAVIS, HERRINGTON, KOTEN

- Information management systems
- Systems analysis
- Geographic information systems application

Information is a vital part of any organization, and as the "information age" develops, management of information is becoming increasingly important to the success of any enterprise. Much of the information foresters and other natural resource managers work with is geographic in nature and is amenable to analysis by spatial techniques. Thus, the focus of Resources Information Management is the use of geographic information systems (GIS) to manage information and provide the needed spatial analysis and modeling. However, nongeographic information is also important, and there is thus a need for traditional management information systems (MIS) technology as well.

As with quantitative methods and urban forestry, resources information management cuts across nearly all of the Faculty of Forestry's areas of study. The strongest interactions are with faculty and students in forest management, forestry economics, policy and administration, watershed management/hydrology, and forest soil science. There are strong ties with the Faculty of Environmental Studies, the Faculty of Forest Engineering, working with remote sensing and photo interpretation, and the faculty in Syracuse University's Advanced Graphics Laboratory, Department of Geography, and the School of Information Studies.

At the master's level, students' programs tend to focus on the application of existing analysis techniques to resource management problems while at the doctoral level, the focus is on the development of analysis and modeling techniques. M.S. students apply resources information management techniques to problems in their respective areas of interest, while Ph.D. candidates focus their energies on the mathematical, information science, spatial modeling, and computer science aspects of finding new ways to solve problems.

Forest Management and Operations (M.F.)

The Faculty of Forestry offers a professional graduate program in forest management and operations leading to the master of forestry degree.

This graduate program is designed for students with an undergraduate forestry education and a primary interest in continuing their professional development through advanced study of the planning, management, and operations necessary for the appropriate use of forest resources. Thirty-seven credit hours of coursework are required in this structured, intensive 11-month program. No thesis is required, but students take a written comprehensive examination in the spring.

Courses in the M.F. program build on and extend the student's basic undergraduate forestry education and provide opportunities to relate theory to actual forestry situations. Emphasis is on methods and skills in modern business management, policy processes, forestry economics, and information systems. Developing managerial skills is a key objective. These skills are then applied to managing forestlands, operating associated enterprises, or using forest resources.

The forest management and operations program consists of lecture courses, seminars, field experiences, and the written examination.

The following courses are representative of the program content:

Field Applications in Forest Management and Operations
Finance (Private Industry) or Public Budgeting (Public Management)
Forest Resource Economics
Advanced Silviculture
Operations Management (Private Industry) or Public Administration (Public Management)
Information Systems for Forest Management Seminars
Pest Management for Forestry
Forest Policy
Organization and Human Behavior
Advanced Forest Management
Field Applications in Integrated Forest Management
Elective

Ranger School—Forest Technology Program

History and Description

In 1912, some 1,800 acres of land in the Adirondack Mountains were donated to the College as a site for the development of a Ranger School. Since that time, the forest technology program has trained over 3,000 graduates, most of whom are now working in a variety of forest activities, and it has earned the Ranger School a national reputation for excellence. The program is administered by and is an integral part of the Faculty of Forestry. This unique model of a single professional Faculty offering all levels of work from technical through post-doctoral emphasizes the teamwork approach to forest resource science and management espoused by the faculty.

The two-year curriculum trains students in forest technology. The degree of associate in applied science (A.A.S.) in forest technology is awarded. The objectives of the curriculum are to provide students with a knowledge of the field practice of forestry as related to forestry managerial needs; the ability to work and communicate effectively with professional and paraprofessional forestry personnel; and an understanding of the sciences and practices of forestry with some emphasis on ecological applications.

Graduates are generally classified as forest technicians, forestry aides (or surveying technicians) in initial employment positions. Forestry agencies and wood-using industries employ forest technicians as an important part of their forest management teams, usually as the "people on the ground" who plan and execute the field practice of forestry, normally under the supervision of a professional forester. (Surveying firms employ 25 percent or more of the graduates each year to work with crews on road, boundary, right-of-way, mapping, construction, and exploration applications of plane surveying.)

The curriculum is designed to allow graduates immediate job entry at the technical level. Students interested in a baccalaureate degree in forestry and resource management should investigate the Faculty of Forestry's bachelor's degree curriculum described on page 92. It should be understood that transfer into the Faculty of Forestry's professional forestry curriculum is possible upon completion of the A.A.S. degree at Wanakena. Transfer into other baccalaureate programs at ESF may be possible, but students should consult as soon as possible with the Undergraduate Admissions Office.

Student who feel transfer to baccalaureate program is a possibility after graduation from the forest technology program, should pay close attention to the footnotes under "Freshman Year" on page 102.

The freshman year forest technology curriculum consists of general studies courses which may be taken at any accredited four-year college, or agricultural and technical institute except SUNY Farmingdale (although transfer credits from this school is acceptable).

The second year of the curriculum is offered at the Faculty of Forestry's forest technology program on the Wanakena Campus. Presented in a varied forest environment, the curriculum's emphasis is on fundamental forestry knowledge and applied field training as well as the relationships between forest technology and managerial needs. About 50 percent of the studies are devoted to field exercises, most of which are held on the School's forest. This managed forest, containing both hardwood and coniferous species, covers an area some 3 miles long with widths varying up to 2 miles. On two sides, the forest is bounded by state forest preserve lands. The forest is also adjacent to several square miles of virgin timber within the Adirondack Forest Preserve. This excellent forest backdrop for the technology program provides a diverse laboratory for instructional purposes.

Since the program is situated within a forest environment, some applicants may mistakenly believe that the forest technology program is one of forest lore and wilderness survival. It is, therefore, strongly emphasized that the forest technology curriculum demands high quality academic achievement. Students cannot complete the program without concentrated and consistent study. Classes are scheduled from 8 a.m. to 5 p.m., Monday through Friday, with classroom and laboratory or field time equally divided. The intensity of the program normally requires a minimum of 70 hours a week of evening and weekend study, daily classes, and laboratory/field exercises. Several short trips are made during the year in connection with courses in dendrology, silviculture, forest management, forest recreation, wildlife ecology, and surveying. Even though the Ranger School's major thrust is in forest technology, surveying is an additional and growing strength of the program.

Surveying Emphasis

In August of 1992, the Ranger School will begin offering additional coursework in surveying for students who wish to pursue a career in land surveying. During the fall semester, both forest

FOREST TECHNOLOGY CURRICULUM
(Associate in Applied Science Degree)

Freshman Year *Credit Hours*
(Completed at a college of the student's choice)

General Biology[1]	6-8
English (a technical report writing course is highly recommended)	6
Math[2]	4-6
Economics	3
Electives[3]	7
	30

[1] Courses selected may be in general biology, but at least one course in introductory botany is preferred.

[2] Competency in plane trigonometry and college algebra is required. If demonstrated, credits become electives. For those students who feel transfer to a baccalaureate program is a possibility, they would be well advised to take calculus.

[3] For those students who feel transfer to a baccalaureate program is a possibility, general chemistry and physics should be taken as electives. Otherwise, courses in sociology, psychology, political science, geology, soils, accounting, business, computer science, etc. are desirable electives.

Senior Year *Credit Hours*
(Ranger School)

First Semester	FTC 200	Dendrology	2
	FTC 202	Plane Surveying I & II	5
	FTC 204	Forest Mensuration and Statistics	3.5
	FTC 206	Forest Ecology	3
	FTC 207	Aerial Photogrammetry	2
	FTC 208	Allied Technologies	2
	FTC 210	Computer Applications	1
	FTC 213	Forest Entomology	1
	FTC 223	Graphics	1
			20.5
Second Semester	FTC 205	Forest Mensuration and Statistics II	2
	FTC 209	Forest Roads	2
	FTC 211	Silviculture	2.5
	FTC 214	Personnel Management	1.5
	FTC 215	Timber Harvesting	2
	FTC 217	Forest Management	3.5
	FTC 218	Forest Recreation	1.5
	FTC 219	Elements of Wildlife Ecology	1.5
	FTC 221	Soil and Water Measurements	1.5
	FTC 226	Forest Pathology	1
	FTC 227	Fire Management	2
	FTC 228	Structure and Growth of Trees	1.5
	FTC 229	Silviculture II	
		or	
	FTC 230	Plane Surveying III	2
			24.5

A total of 75 credit hours is required to complete the A.A.S. degree in forest technology.

technology and surveying students will take the same sequence of courses. In the spring semester, students admitted into the surveying emphasis will take 11-1/2 credit hours of surveying coursework in place of forestry-oriented courses.

Students interested in the surveying emphasis should use the seven credit hours of electives available in the freshman year to take courses in physics, analytic geometry, or introductory calculus.

Information regarding the surveying emphasis may be obtained from the Director of the Ranger School.

Life at Wanakena

The Ranger School of the College of Environmental Science and Forestry is located on the banks of the Oswegatchie River near the hamlet of Wanakena, approximately 65 miles northeast of Watertown, and 35 miles west of Tupper Lake. The program's buildings and its surrounding forest border on the river which flows directly into Cranberry Lake.

The main building consists of a central service unit with dormitory wings on either side. The central unit contains classrooms, laboratories, a student lounge, faculty offices, the library, a kitchen, dining room and 22 double occupancy and 13 single occupancy dorm rooms.

Faculty houses are nearby on the campus. Other buildings include a maintenance shop, garages, a sugar house, and storage buildings.

The close proximity of faculty offices and student quarters and the intensive field work pattern enables students to consult easily and frequently with the faculty. The program considers this traditional close student-faculty association to be of major benefit in its educational program.

A small library of approximately 1,500 volumes consists of highly specialized materials required for the teaching and study programs of the curriculum.

Students taking the second year of the forest technology curriculum at the Ranger School are required to live in the campus's dormitories. An exception may be made for married students who bring their families and rent their own private accommodations in the vicinity. Such accommodations are not plentiful. Each married student should make rental arrangements well in advance of the registration date.

The Ranger School does not maintain an infirmary, nor does it employ a physician or nurse. There are two physicians and a dentist as well as an excellent community hospital in nearby Star Lake, New York. In emergency, situations, the program transports sick or injured students to the local physician of their choice or to the hospital. Health and accident policies for students are available through Syracuse University, and it is strongly suggested that the student consider such coverage before reporting to the campus. Application forms are available through ESF's Office of Student Affairs and Educational Services.

Because of the comparatively isolated location of the Ranger School, a stock of books and supplies used in connection with the second year of the program is maintained on campus for sale to students.

During the first year of the program, students will be guided by the rules and regulations that govern attendance at their local campus. During the second year of the program, students will be guided by the general rules and regulations for College of Environmental Science and Forestry students and an additional set of Ranger School "house rules."

Admission Requirements

Admission into the forest technology curriculum requires the following high school units: English (4 units); social science (3 units); science (2 units, including biology); mathematics (3 units, college preparatory); and electives. Mechanical drawing, technical report writing, and computer science are suggested electives.

In addition to the academic requirements, the following must also be met by all applicants:

1. The applicant must be strongly motivated toward a career in field forestry or surveying.
2. The applicant must be willing and able to meet the physical requirements of the program which include pole and tree climbing, walking 2 to 6 miles through forest areas, often carrying 15 to 20 pounds of equipment, and using a wide array of hand tools and power equipment.
3. The applicant's parents (if the applicant is under 18 years of age) must be fully aware of the field nature of the study program, its rigorous study-work regime and supporting academic facilities.
4. A full medical examination report must be submitted.

Questions concerning any of these requirements should be referred to the Director of Admissions.

Admission Procedures

The decision to admit any student to the forest technology program rests solely with the College of Environmental Science and Forestry. Most openings in the program are filled by students who received conditional acceptances while still seniors in high school, contingent on successful completion of the first year of college. Remaining openings are filled by transfer students who have already attended college. Therefore, it is suggested the potential forest technology student, while still a high school senior, follow these procedures:

1. Submit a regular SUNY freshman application for the College of Environmental Science and Forestry, using a Curriculum Code 620 (Forest Technology). These applicants should indicate entry date to be one year in advance of the current year.
2. Submit a regular application to that schoolselected for the first year of study, using Curriculum Code 620. It is important that students gain entry on their own for the first year of studies. ESF will request information at a later date concerning what institution the student will be attending.

Effective fall 1991, a limited number of outstanding students will be admitted directly from high school. For further information, contact the Director of Admissions.

Transfer Students

Students with previous college experience, or students who are currently enrolled at another college, may apply for transfer. However, courses transferred for credit can be applied only to the freshman year course of studies, and they must be comparable in subject matter, content, and level. All second year courses must be taken at the Ranger School, and, therefore, a student cannot transfer any previously earned credit toward the second year. Transfer applicants must submit a recent official copy of their college transcript and a list of courses they anticipate completing prior to enrollment.

Expenses

Cost of the first year will vary with the specific institution attended.

Estimated costs of the second year program at the Ranger School are as follows:

	N.Y. Resident	
Tuition	*Board, Room*	*Books, Supplies*
$2,150	$4,640	Approx. $1,000
	Nonresident	
Tuition	*Board, Room*	*Books, Supplies*
$5,750	$4,640	Approx. $1,000

An expense of approximately $200 for laundry and clothing should be anticipated. There is also a $20 graduation fee, a student support services fee of $175, a $13 student activity fee, and a Camp Allegany fee of approximately $90. There are a limited number of single dorm rooms available for an additional $200. There is also a $25 resident deposit and a $25 equipment deposit. The latter two fees are fully or partially refundable, depending on breakage charged to a student during the year.

Financial Aid

Financial aid is available upon acceptance to the College of Environmental Science and Forestry. There are three basic loans, scholarships or grants, and part-time employment.

More detailed information on these financial aid opportunities can be found on pages 23-29 of this catalog and the publication Financial Assistance at ESF.

The student must file an application with the Office of Financial Aid at the Syracuse Campus and submit a Family Financial Statement to ACT, Iowa City, Iowa 52243.

Placement

The Ranger School assists in placement of graduates. The excellent reputation which the graduates of the Ranger School at Wanakena have developed in all types of forestry and surveying jobs greatly assists today's graduates to find employment. Employment is common with local, state and federal forestry and land resource agencies, private forestry enterprises, and surveying firms. Positions most frequently filled by recent graduates include: state forest ranger, state forest technician, forest aide, industrial forest district supervisor, timber inventory specialist, timber sales supervisor, forest surveyor, forest engineering aide, forest protection technician, forest research technician, forest equipment salesman, tree service technician, and urban park ranger.

The Faculty of Landscape Architecture

RICHARD S. HAWKS, Chair
331 Marshall Hall
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Faculty: CARTER (Urban Design, City and Regional Planning, Development Process, Planning and Design Theory), CURRY (Site Planning, Urban Analysis and Design, Historic Preservation), FREEMAN (Site Design, Plant Materials, Graphics), HANSELMAN (Communications Strategies and Message Design, Non-Print Communications), HAWKS (Regional Planning and Design, Natural Factors in Design, Geographic Information Systems, University Campus Design and Planning), LEWIS (Community Land Planning; Planning Process, Computer-Aided Community Land Planning, Computer-Aided Mapping, Geographic Information System Applications in Land Planning and Land Use Controls), MARAVIGLIA (Technical Graphics, Creative Problem Solving, Education, Communication, Video, Management), MILLER (Site Design, Graphics, Plant Materials, Provision for Play, Video Simulation), J. PALMER (Landscape Perception, Design Evaluation, Social Impact Assessment, Environment and Behavior Research Methods), POTTEIGER (Cultural Landscape History, History of Landscape Architecture, Design Theory and Methodology), REIMANN (Environmental Design, Passive Energy Conservation, Site Planning and Design), REUTER (Ecology in Landscape Planning, Design and Management of Wetlands; Computer Applications in Environmental Planning and Design Simulation), SHANNON (Site Planning and Design; Urban Analysis and Design; Historic Landscape Preservation Planning; Computer Applications), STRIBLEY (Design and Behavior; Public Participation; Urban Design, Parks and Recreation; Site Planning and Design)

Landscape Architecture

The alteration of the physical environment has been a product of human activity since the earliest times of human settlement. While environments of enduring beauty and vitality occasionally resulted, the history of environmental manipulation more often demonstrated degradation and abuse of the landscape. As the knowledge of natural and human processes has expanded, environmental change has been transformed over the centuries from the casual efforts of many to that requiring skilled individual effort and often demanding multidisciplinary attention.

The Faculty of Landscape Architecture offers two programs designed to educate students to contribute in varied ways to the wise use of land and landscape. Each degree program provides a basis for students to establish career directions in the profession landscape architecture. Both the bachelor and master of landscape architecture are offered.

Support Facilities

The facilities for landscape architecture include individual studio space for each student, office space for funded projects and advanced standing students, a photographic darkroom, PC and Macintosh computer clusters, and a wide assortment of photographic, video, and environmental measurement instrumentation. Computer facilities focus on CAD, GIS, desktop publishing, video image processing, and graphic design and visual simulation systems.

College facilities include a campus library, a fully equipped video recording and processing studio, various environmental measurement laboratories, and a mapping science laboratory with remote sensing, photogrammetry, GIS and digital image processing capabilities. The ESF computer labs contain networked PCs, Macintoshes, work stations and mainframe terminals. All campus computing facilities are linked with Syracuse University for campus-wide support of computing activities.

Bachelor of Landscape Architecture

The B.L.A. program is designed for those students desiring to enter the profession of landscape architecture either directly after completing the degree or after completing graduate school. This is a professional degree with an emphasis on the skills and knowledge required to qualify as a landscape architect. The degree is accredited by the American Society of Landscape Architects (ASLA). The B.L.A. degree is granted at the end of five years of study and requires the successful completion of 160 credit hours. Students enter into the third year of the program with a minimum of 62 lower division credit hours and follow the prescribed curriculum.

The B.L.A. program consists of a core of courses involving the basic principles and skills of land-

scape architecture design, land manipulation and engineering, applied ecology, and communications. Additionally, students are required to participate in an independent study semester of the off-campus program during the fall semester of the fifth year. The off-campus program requires students to cover tuition, books and materials, room and board, and travel cost to the location of study. The major objective of the B.L.A. program is the development of basic proficiency in design, engineering, and communication skills necessary for formal admission into the profession of landscape architecture.

When the prerequisite period of work experience has been completed, a person holding a B.L.A. degree may obtain a license to practice landscape architecture. At present, the State of New York requires those holding a five-year B.L.A. degree to complete a three-year period of internship in the field prior to applying for the licensing examination. Other states have varying requirements for obtaining a license.

As in any area of professional study, students seeking the B.L.A. degree are expected to demonstrate a high level of commitment and scholarship in their studies. This professional commitment is demonstrated by a desire to serve society in an objective, rational, and ethical manner.

Students receiving a B.L.A. degree have entered the profession as employees in public agencies or in private offices offering landscape architectural services. Also, B.L.A. graduates have entered graduate schools in landscape architecture, planning, urban design, regional design, and specific specialties including historic preservation, environmental policy, management, and research.

Prerequisites for Entry into the B.L.A. Degree Program

The breadth of concern of the B.L.A. program makes it imperative that entering students prepare themselves with a broad range of lower division coursework. The environmental efforts with which the students will be involved require a strong background in both the natural and social sciences. In addition, prior skill development in graphics, mathematics, and computer science is required.

(Cont. on p.108)

Lower Division Courses

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area .... *Credit Hours*

Written and Oral Communication 6
Required credit hours in this area must be taken in courses dealing with English comprehension, the basic skills of grammar and composition, and public speaking.

Graphics 3
A minimum of one course in engineering drawing, mechanical drawing, or architectural drafting is required.

Natural Sciences 6
Required credit hours in this area must include a course in botany or plant biology. Additional hours should be taken from coursework in ecology,* physical geography, earth science, geology, or environmental geology.

Social Sciences 3
Required credit hours in this area are to be taken from coursework in U.S. history, sociology, social psychology, social or cultural anthropology, political science, or economics.

Mathematics 3
Required coverage of college trigonometry. Students with prior coverage in math who can demonstrate proficiency at time of admission may substitute elective hours for this prerequisite. More advanced math is desirable.

Computer Science 3
Introduction to computers with basic application programs including word processing, spread sheets, and data base. Familiarity with microcomputers and programming preferred.

Electives 38

Total minimum lower division credits 62

*Can be waived at ESF if completed prior to transfer.

Upper Division Courses

Third Year			*Credit Hours*
First Semester	ESF 332	Seminar for New Transfer Students	0
	LSA 320	Introduction to Landscape Architecture and Planning	3
	LSA 326	Landscape Architectural Design Studio I	3
	CMN 382	Graphic Communication	3
	LSA 411	Natural Processes in Planning and Design	3
	EFB 320	General Ecology or Elective*	3
			15
Second Semester	LSA 327	Landscape Architecture Design Studio II	3
	LSA 330	Site Research and Analysis	2
	EIN 371	History of American Landscape Attitudes	3
	EIN 390	Social/Cultural Influences and Environmental Form	3
	ERE 306	Elements of Map and Air Photo Interpretation or Elective*	1
	ERE 308	Elements of Plane Surveying or Elective*	1
	CMN 404	Technical Writing	3
			16
Fourth Year			*Credit Hours*
First Semester	LSA 422	Landscape Design Studio III	4
	LSA 433	Plant Materials	2
	LSA 434	Design Materials	1
	LSA 442	Site Grading	2
	LSA 443	Site Drainage Systems	1
	EIN 470	Art History or Elective*	3
	Elective		3
			16
Second Semester	LSA 423	Landscape Design Studio IV	4
	LSA 425	Orientation for Experiential Studio	2
	LSA 444	Vehicular Circulation Design	1
	LSA 445	Introduction to Structures	1
	EIN 451	Fundamentals of City and Regional Planning	3
	EIN 471	History of Landscape Architecture	3
	LIB 300	Library Research	1
	Elective		2
			17
Summer	LSA 533	Plant Materials	2
Fifth Year			*Credit Hours*
First Semester	LSA 524	Experiential Landscape Design Studio V (Off-Campus Program)	16
Second Semester	LSA 522 or	Landscape Design Studio VI—Urban Design	4
	LSA 525 or	Landscape Design Studio VI—Site Design	4
	LSA 527	Landscape Design Studio VI—Regional Design	4
	LSA 545	Professional Practice Studio	3
	LSA 455	Professional Practice in Landscape Architecture	2
	Architecture Elective		3
	Elective		4
			16

*Elective only with prior coverage in required area.
A total of 160 credit hours is required to complete the B.L.A. degree.

The required prerequisite coursework described on page 106 must be met to prepare the entering student to engage the B.L.A. curriculum.

Elective Guidelines

Students planning to transfer to the bachelor of landscape architecture program should consider the following as guidelines in selecting their 38 credit hours of electives. The following subject areas are considered highly desirable. Course areas marked (*) are required following transfer to the program, but can be waived if completed prior to transferring. This will allow a student to take additional electives at ESF.

1. In addition to the required prerequisite credit hours listed, further subject coverage in written and oral communications, natural sciences, and social sciences as listed is recommended.
2. Art and Design
   Courses in this category should include art history* and studio art. Studio courses in drawing or three-dimensional design, sculpture, ceramics, and photography, are recommended.
3. Analytical Tools
   Courses in this category should include elementary plane surveying*, air photo interpretation*, or elementary physics. Additional work in computing technology is highly recommended, particularly in the realm of computer graphics and computer-assisted design (CAD).

Demonstration of academic excellence in environmental design and design graphics through submission of a portfolio is highly recommended as part of the admission's process to the B.L.A. program.

BLA/MLA Fast Track

This program is available to outstanding fourth-year bachelor of landscape architecture students and provides the opportunity to receive both the bachelor of landscape architecture and master of landscape architecture degrees during a four-year period at the College. Students who apply must have a minimum 3.000 G.P.A. and are accepted into the program during the fall semester of the fourth-year of the bachelor of landscape architecture program. During spring semester the transition begins between the bachelor of landscape architecture and master of landscape architecture curriculum requirements. Both degrees are awarded at the completion of 190 credit hours (62 lower division credit hours transferred to the College upon entering the bachelor of landscape architecture third-year and 128 credit hours earned at the College).

Master of Landscape Architecture

The master of landscape architecture (M.L.A.) degree is fully accredited by the American Society of Landscape Architects (ASLA) and satisfies the professional degree requirements of the Council of Landscape Architectural Registration Boards (CLARB) for participation in the Uniform National Examination (UNE). Satisfactory completion of the UNE is the main avenue to licensure in all states requiring licensing of professional landscape architects.

The M.L.A. degree is attractive to a broad range of people—those with undergraduate degrees in landscape architecture who seek specialized training or an academic career option, those with degrees in related design and planning fields (like architecture, urban and regional planning, and environmental design) who wish to broaden or redirect their design and planning skills, and those with degrees in fields less closely related to landscape architecture (like general humanities, arts and sciences) who seek new career options or wish to apply prior interests through a licensed design and planning profession. In response to these differing educational backgrounds, three curriculum tracks are provided: (1) a two-year program for applicants with a previous landscape architectural degree, (2) a two and one-half year program for applicants with related design and planning degrees, and (3) a three-year program for applicants with degrees unrelated to landscape architecture. There is also a fast-track program that enables qualified candidates within our B.L.A. program to proceed directly into the M.L.A. program and finish both degrees concurrently. Refer to the previous section for information on the fast-track option.

The educational vision of the graduate program is to provide a well-balanced general professional practice curriculum on landscape architectural design and planning, coupled with opportunities to pursue individualized advanced study in a broad range of topics. Faculty interests and expertise includes land planning, urban design, site design, human behavior studies, historic preservation, cultural landscape resource planning, visual landscape assessment, design simulation, wetland assessment and mitigation, applied ecology and vegetation management, rural community planning, and computer applications entailing: (1) computer-aided drawing and design (CAD), (2) geographic information systems (GIS), (3) video and digital image processing, (4) desktop publishing (DTP), and (5) other general and technical applications. Educational opportunities are enhanced

further with the inclusion of expertise from allied faculty from ESF and Syracuse University.

M.L.A. Students With A Previous Landscape Architectural Degree

This is a two-year degree track for individuals possessing an undergraduate degree in landscape architecture, requiring 42 credit hours of graduate work for students with an ALSA accredited B.L.A. degree. The credit requirement may be reduced to as low as 30 credit hours for students with an accredited B.L.A. degree and professional work experience. Degree requirements may also exceed 42 credit hours for international students and others with non-accredited landscape architectural degrees.

The two-year degree track is for students who seek the challenge of advanced study in the field of landscape architecture. The track has few required courses other than those determined by the major professor and graduate steering committee as essential to a students' chosen area of interest. Generalized curriculum plans are discouraged in preference to individualized courses of study that direct students toward achieving advanced skills in the field. The main thrust is to allow students to customize their study and focus on specialized knowledge they wish to gain.

Students are expected to enter this track with specific academic goals that define their area of specialization. During their first semester, students are expected to select a major professor and prepare a degree plan outlining their academic program and final integrative experience. Domestic students are required to complete 6 to 12 credit hours of thesis or project (LSA 899) as their final integrative experience, while international students are encouraged to pursue internship or coursework integrative experiences.

M.L.A. Students With A Related Design and Planning Degree

This is a two and one-half year degree track requiring 56 credit hours of graduate work for individuals with related design and planning degrees (e.g., architecture, urban design, environmental design, regional planning, etc.). Credit requirements may be reduced for individuals with professional design experience and a good design portfolio. Degree requirements may also exceed 56 credit hours for international students and those with weak credentials in graphics, design, construction, and design practice.

The two and one-half year track is for students who seek to broaden or redirect their design and planning skills to include practice in landscape architecture. The academic program for this track looks very similar to the three-year track, with introductory design, graphics, and professional practice coursework eliminated for those with relevant background. The emphasis on the required coursework is to establish the historical, theoretical, and technical design skills expected for licensure as a professional landscape architect. However, students are expected to pursue advanced study in an area of their interest with a major professor and graduate steering committee of their choice. The main thrust of this track, therefore, includes both primary training as a professional landscape architect and expectations of graduate level advanced study in the field.

Students are expected to explore various aspects of the field for their first year, then select a major professor during their third semester and prepare a degree plan outlining their academic program and final integrative experience. Domestic students may select thesis, project, internship, or coursework final integrative experiences, while international students are encouraged to pursue internship or coursework integrative experiences.

M.L.A. Students With No Previous Professional Design or Planning Degree

The M.L.A. three-year degree track is the academic program accredited by ASLA as the "first professional degree." It is for students with no prior background in design and planning who seek new career options in landscape architecture. This track has two full years of required coursework emphasizing historical, theoretical, and technical design skills expected for licensure as a professional landscape architect. However, the student is expected to pursue advanced study in an area of their interest during the third year. The main thrust, therefore, includes both primary training for practice in landscape architecture and expectations of graduate level advanced study in the field. Students are expected to explore various aspects of the field for their first three semesters, then select a major professor during their fourth semester and prepare a degree plan outlining their academic program and final integrative experience. Domestic students may select thesis, project, internship, or coursework final integrative experiences, while international students are encouraged to pursue internship or coursework integrative experiences.

The following schedule of courses illustrates a typical three-year program.

First Year *Credit Hours*

CMN 552[1]	Graphic Communication	3
LSA 320[3]	Introduction to Landscape Architecture	A
LSA 433	Plant Materials	2
LSA 600[1]	Design Studio I—Introductory Design	4
LSA 601	Design Studio II—Site Design	4
LSA 611	Natural Factors Analysis	3
LSA 615	Introduction to Site Construction	3
LSA 640[2]	Research Methodology	3
LSA 671	History of Landscape Architecture	3
LSA 697	Topics and Issues of Landscape Architecture	1
Directed Electives[4]		Varies
		26

Second Year *Credit Hours*

LSA 620	Design Studio III—Advanced Site Design	4
LSA 621	Design Studio IV—Community Design and Planning	4
LSA 650	Behavioral Factors of Community Design	3
LSA 652	Community Development and Planning Process	3
LSA 654	Ecology in Landscape Design and Planning	3
LSA 655	Professional Practice	4
LSA 799[2]	Proposal for Thesis/Project or Internship	1
Directed Electives [4]		Varies
		22

Third Year *Credit Hours*

LSA 700[6]	Design Studio V—Integrative Studio	4
Integrative Experiences, Program Alternatives:[5]		
LSA 898	Professional Practice Internship	6-12
LSA 899[2]	Thesis/Project	2
Directed Electives [4]		Varies
		18

[1]May be waived for students with undergraduate design degrees based on portfolio review.

[2]Required for students who enter with a previous degree in Landscape Architecture.

[3]Audited concurrent with LSA 697, Topics and Issues of Landscape Architecture.

[4]Directed electives are selected in consultation with the student's major professor to complete credit hour requirements. They are designed to augment the student's undergraduate preparation and may comprise the coursework integrative experience in the third year.

[5]The precise number of credit hours taken by a student in LSA 898, LSA 899, and in complementary directed electives, during a given semester is determined in consultation with the student's major professor.

[6]Required studio for coursework integrative experience.

Final Integrative Experience

All graduate students are expected to complete a final integrative experience as the advanced study component of their program. Alternatives for this integrative experience include: (1) thesis or project, (2) internship, and (3) coursework. A thesis is the culmination of research in which new, original knowledge is generated, while a project focuses instead on the application of existing knowledge to a new situation. Internships entail a learning experience through a public agency, non-profit organization, or private professional firm that enhances the educational program of the individual student. Coursework is the pursuit of a body of knowledge through completion of supporting elective classes.

Prerequisites and Admission Requirements

Students seeking admission to the M.L.A. program may apply to enter based on education and experience. Admission requires:

1. An undergraduate degree.
2. Graduate Record Examination scores.
3. Undergraduate transcript (3.000 average in junior and senior years generally required)*.
4. Three letters of recommendation.
5. A completed course is recommended in each of the following six areas:
   a. botany, biology, or ecology.
   b. geology, geomorphology, or earth science.
   c. anthropology, psychology, or sociology.
   d. computer applications.
   e. drawing, drafting.
   f. art or architecture history.

Specific requirements may be waived based upon the complete application package and applicant's status.

Students seeking admission to the two year and two and one-half year degree tracks must additionally have:

1. An accredited or recognized design or planning degree; (3.000 average in major during the last two years).
2. A design portfolio.

Applicants may be assessed as deficient in one or more areas deemed important to their admission to graduate study in the program. Courses taken to make up deficiencies (e.g., English for international students) may not count towards the credit hours required for the graduate degree.

Applications should be made prior to March 15 for fall admission. Visits to the College are encouraged and highly recommended.

Research and Community Service

Research and community service are important aspects of the graduate experience in landscape architecture. Students may participate in the funded studies directed by individual faculty, or in unique studies of their own design. Furthermore, many community service projects are performed in the context of a design studio, thereby bringing real world problems into the studio as a learning experience. In this way, the on-going efforts of students and faculty help to further develop the body of knowledge of the field, while providing a challenging academic environment for the students.

The Faculty of Landscape Architecture believes that computer and video technologies are very important to the future of the profession. They are committed to exploring the application of digital technologies to the practice of landscape architecture, and encourage the use of these technologies by the students. Advanced students may choose to specialize in the application and integration of computer technologies as part of their final integrative experience.

College and Regional Context

Students in the graduate program in landscape architecture have an excellent opportunity to draw upon the extensive college expertise in ecology, natural sciences, resources management, engineering, forestry, and many other environmental disciplines. Add to this the resources available through Syracuse University, like architecture, geography, and the Maxwell School of Public Affairs, and the breadth of academic choices offered to a student at ESF becomes very significant.

The City of Syracuse has the largest concentration of professional landscape architectural offices in the Central New York State region. This centralized location also provides easy access to major metropolitan centers like, Toronto, Montreal, New York, Boston, and Buffalo, and to unique rural and natural landscapes like the Catskills, the Adirondack Park, and Lake Ontario. Basic geography, therefore, provides the student with a wide diversity of natural and cultural contexts in which to pursue academic and career goals.

Graduate Assistantships

Students with associated professional degrees may be considered for a graduate assistantship (stipend and tuition scholarship) upon admission, depending upon qualifications and portfolio. Other students may apply for landscape architecture graduate assistantships after the first year of the first professional degree track. Assistantships may also be available with community service or research projects, and are awarded by individual faculty to students with the necessary qualifications.

The Faculty of Paper Science and Engineering

LELAND R. SCHROEDER, Chair
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LELAND R.SCHROEDER, Chair (Organic Chemistry, Pulping, Bleaching) BAMBACHT (Pulping, Papermaking, Paper Machine Operation), CROSBY (Paper Properties and Microscopy), EUSUFZAI (Paper Properties and Sheet Morphology), FRANCIS (Chemical Engineering and Pulping), HOLM (Water and Air Pollution Abatement, Computer Simulation), HOLTZMAN (Papermaking, Paper Machine Operations), JELINEK (Computer Applications, Process Engineering, Thermodynamics), LAI (Organic Chemistry, Pulping, Bleaching), LUNER (Surface and Colloid Chemistry of Papermaking Systems), MARK (Mechanical Properties of Fibers and Paper), RAMARO (Chemical Engineering, Instrumentation, Flow Phenomena, Process Control), THORPE (Fiber Physics, Paper Physics and Mechanics), UNBEHEND (Wet End Chemistry).

Paper science and engineering provides a broad base of study to prepare men and women for professional positions in the pulp and paper industry. This industry is the fifth largest in the nation and is very strong internationally. The College pioneered instruction for the pulp and paper and allied industries in 1920 with the formation of a paper science and engineering department which has maintained a singularly high position in this area of professional education. This program has a longstanding reputation for preparing graduates for rewarding positions as research chemists, process engineers, technical service representatives, managers, and many others. Graduates have advanced to positions of leadership in research, management, technical operations, and sales in the pulp and paper industry as well as allied industries of heavy equipment manufacture, process chemicals, and other supply industries.

The program provides education in the physical sciences and chemical engineering, with specific emphasis on those aspects of these disciplines which relate to the manufacture of pulp and paper. This includes the chemistry and anatomy of wood, the conversion of wood to pulp and paper, and the chemistry and physics of paper and paper formation. All options include the basics of chemical engineering with a foundation of unit operations and specialized courses, for example, in air and water pollution abatement for the pulp and paper industry. The engineering option extends this foundation to present a chemical engineering education tailored specifically to the pulp and paper industry.

Paper science and engineering is located in Walters Hall, the facilities of which are devoted to education and research in the field of pulp and paper. In addition to a large number of special purpose laboratories and highly sophisticated scientific equipment, there is an experimental pulp and paper mill equipped with machinery and instrumentation for studies of pulping, pulp purification, recycling, refining, paper additives and papermaking. Equipment includes two complete paper machines, one 48-inch and one 12-inch, a pressurized refiner for mechanical pulping, and auxiliary equipment. An environmental engineering laboratory is designed to research various methods of paper recycling and waste treatment. A new state-of-the-art laboratory for testing paper and other materials is in service. The environmental controls for this laboratory provide a wide range of humidities with exceptional accuracy. This equipment as well as the extensive chemical engineering laboratory is employed for both education and research. Computer hardware and software is continually updated for teaching and research in process control and simulation.

Undergraduate Program

The curriculum may be entered at the freshman level or junior level by students having an associate degree in engineering science, chemical technology, or science and mathematics. The engineering science associate degree is well suited to the engineering option. Some latitude is available if the student's background includes most of the courses shown under "Lower Division Courses." The opportunity is also available to enter with fewer background courses if the student plans to extend his or her stay at the College. The student may elect to extend the time to complete the program by use of a cooperative work-study plan to help in financing the education as well as to gain experience to help in shaping a future career. All students are required to complete a 12 week intern program in the industry (PSE 304). The experience and financial return are valuable benefits. The student

can also qualify for a full-tuition scholarship from the Syracuse Pulp and Paper Foundation.

The Science Option

The science option consists mainly of chemistry and chemical engineering courses and specialized courses relating to the manufacture and use of pulp and paper products. The technical elective concentration allows the student to select a subject area of interest in which to specialize. This option prepares the student for careers in the technical, management, or technical representative areas with opportunities to extend interests in other directions.

Lower Division Courses

Students entering this program through the freshman admissions option should refer to page 55.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
Botany or Biology with Laboratory	4
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory	8
Quantitative Analysis	3
Physics with Laboratory	8
Mathematics—Calculus I, II, III and/or Differential Equations	12
Computer Science	3
Economics	3
English	6
Engineering Drawing	1
Humanities or Social Science Electives	8
Total minimum lower division credits	64

Upper Division Courses

Science Option

Junior Year

			Credit Hours
First Semester	ESF 332	Seminar for New Transfer Students	0
	FCH 360	Physical Chemistry I	3
	FCH 572	Wood Chemistry II	3
	PSE 300	Introduction to Papermaking	3
	PSE 370	Principles of Mass and Energy Balance	3
	PSE 371	Fluid Mechanics	3
	PSE 496	Special Topics (Technical Writing)	2
	LIB 300	Library Research Methods	1
			18
Second Semester	FCH 361	Physical Chemistry II	3
	PSE 386	Structure and Properties of Wood	2
	WPE 390	Fiber Identification Laboratory	1
	PSE 301	Pulp and Paper Processes	3
	PSE 372	Heat Transfer	3
	Electives *		6
			18

Summer Mill Experience:

Twelve weeks of full-time pulp and/or paper mill employment approved by the Faculty, PS 304 2

Senior Year *Credit Hours*

First Semester	PSE 461	Pulping Technology	3
	PSE 465	Paper Properties	4
	PSE 473	Mass Transfer	3
	PSE 477	Process Control	3
	PSE 491	Paper Science and Engineering Project I	1
	Elective*		3
			17
Second Semester	PSE 466	Paper Coating and Converting	2
	PSE 468	Papermaking Processes	3
	ERE 440	Water Pollution Engineering	3
	Electives *		6
			14
	Total minimum upper division credits		69

*At least 9 credit hours of electives must be selected from an advisor-approved sequence of technical courses. Examples of acceptable elective concentration areas are shown below.

- Colloid and Surface
- Polymer Chemistry
- Applied Mathematics
- Management
- Engineering Design
- Independent Research Project
- Chemistry Instrumental Analysis
- Pollution Abatement
- Computer Modeling
- Mechanics
- Materials Science

A total minimum of 133 credit hours is required to complete the B.S. degree in the PSE science option.

Management Minor

Junior Year *Credit Hours*

First Semester	ESF 332	Seminar for New Transfer Students	0
	FCH 360	Physical Chemistry I	3
	FCH 572	Wood Chemistry II	3
	PSE 300	Introduction to Papermaking	3
	PSE 370	Principles of Mass and Energy Balance	3
	PSE 371	Fluid Mechanics	3
	PSE 496	Special Topics —Technical Writing	2
	LIB 300	Library Research Methods	1
			18
Second Semester	FCH 361	Physical Chemistry II	3
	WPE 386	Structure and Properties of Wood	2
	WPE 390	Fiber Identification Laboratory	1
	PSE 301	Pulp and Paper Processes	3
	PSE 372	Heat Transfer	3
	FOR 360	Principles of Management	3
	Elective *		3
			18

Summer Mill Experience:

Twelve weeks of full-time pulp and/or paper mill employment approved by the Faculty, PSE 304 2

Senior Year

			Credit Hours
First Semester	PSE 461	Pulping Technology	3
	PSE 465	Paper Properties	4
	PSE 473	Mass Transfer	3
	PSE 477	Process Control	3
	PSE 491	Paper Science and Engineering Project I	1
	Elective		3
			17
Second Semester	PSE 456	Management in the Paper Industry	3
	PSE 466	Paper Coating and Converting	2
	PSE 468	Papermaking Processes	3
	ERE 440	Water Pollution Engineering	3
	Elective *		3
			14
	Total minimum upper division credits		69

*At least 9 credit hours of electives must be used to complete the following courses: FIN 355 Money and Banking, LPP 255 Introduction to the Legal System, and either MAR 355 Marketing and Society or PIR 355 Introduction to Personnel.

A total minimum of 133 credit hours is required to complete the B.S. degree in PSE with a management minor.

Engineering Option

Junior Year

			Credit Hours
First Semester	ESF 332	Seminar for New Transfer Students	0
	FCH 360	Physical Chemistry I	3
	FCH 572	Wood Chemistry II	3
	PSE 300	Introduction to Papermaking	3
	PSE 370	Principles of Mass and Energy Balance	3
	PSE 371	Fluid Mechanics	3
	PSE 496	Special Topics (Technical Writing)	2
	LIB 300	Library Research Methods	1
			18
Second Semester	FCH 361	Physical Chemistry II	3
	WPE 386	Structure and Properties of Wood	2
	WPE 390	Fiber Identification Laboratory	1
	PSE 301	Pulp and Paper Processes	3
	PSE 372	Heat Transfer	3
	APM 395	Probability and Statistics for Engineers	3
			15

Summer Mill Experience:

Twelve weeks of full-time pulp and/or paper mill employment approved by the Faculty, PSE 304 2

Senior Year			Credit Hours
First Semester	PSE 361	Engineering Thermodynamics	3
	PSE 465	Paper Properties	4
	PSE 473	Mass Transfer	3
	MEE 225	Statics and Dynamics	4
	ELE 221	Electrical Network Theory	3
			17
Second Semester	PSE 466	Paper Coating and Converting	2
	PSE 468	Papermaking Processes	3
	PSE 480	Process and Plant Design I: Analysis	3
	ERE 440	Water Pollution Engineering	3
	CIE 325	Mechanics of Deformable Bodies	3
	ELE 394	Electrical Network Laboratory	1
			15

Fifth Year			Credit Hours
First Semester	PSE 461	Pulping Technology	3
	PSE 477	Process Control	3
	PSE 481	Process and Plant Design II: Synthesis	3
	Elective *		3
			12
	Total minimum upper division credits		79

A total minimum of 143 credit hours is required to complete the B.S. degree in the PSE engineering option.

The Management Minor

The management minor was developed from the science option by concentrating the electives in management-specific courses. The student, therefore, combines a strong technical background with a firm base in management. The student should have completed a course in microeconomics and an accounting course prior to entering the junior year.

The Engineering Option

The engineering option has been designed to provide an accreditable chemical engineering education for the student preparing for an engineering career in the pulp and paper industry. The courses are designed to present the principles of engineering with the disciplines and examples selected especially for the pulp and paper industry. Courses have been added in the areas of basic principles in electricity, statics and dynamics, and mechanics, as well as thermodynamics and design. The graduate is prepared to move into assignments in the engineering field and advance quickly to positions of responsibility in the analysis and design of processes and equipment. The engineering option is especially flexible in terms of extending the course of study to fit individual backgrounds.

The student who enters the junior year with all lower division requirements in place, will need to make the choice between the engineering and science options prior to entering the fall semester of the senior year.

Graduate Opportunities

The faculty participates in graduate education leading to the master of science and doctor of philosophy degrees through the program in environmental and resource engineering. See page 59 for more information on this program.

Graduate studies reflect the strong trend toward diversification in the industry and offer opportunities for study in a variety of subjects related to the manufacture of pulp and paper. Individual study programs are designed to meet specific personal needs.

An important component of the graduate program is thesis research under direction of a major professor. Much of this research is carried out under the auspices of one of the outstanding research facilities of the world, the Empire State Paper Research Institute (ESPRI), an integral part of the Faculty. Its research activities aim to generate new information regarding the fundamentals, the science, the engineering and the technology of the papermaking process, utilizing advanced techniques such as computer simulation, electron microscopy, specialized spectrophotometry, nuclear magnetic and electron spin resonance and nuclear tracer methods. Recent work has been directed to fundamental investigations of pulping, bleaching, additives, paper recycling, effluent disposal, the papermaking process, the properties of paper, reactions of wood components during mechanical and chemical treatments, the structure of wood and wood fibers, evaporation, fluid dynamics, heat transfer, and chemical recovery. Pilot scale equipment in Walters Hall is often used as an integral part of these research programs.

Many research projects are carried out in cooperation with other College faculties. Examples of such projects include a wide-ranging study of toxicity of paper industry effluents in cooperation with the Faculty of Environmental and Forest Biology, and a cooperative project on the theoretical and experimental analysis of the mechanical properties of fiber and paper with the Department of Aerospace and Mechanical Engineering at Syracuse University. Cooperative studies enable access to the latest equipment in the computer field, including "super" computers.

The faculty enjoys excellent external support in the form of graduate assistantships, fellowships, and grants from ESPRI, the Syracuse Pulp and Paper Foundation, and other industry sources, as well as a number of govemment granting agencies.

The Faculty of Wood Products Engineering

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LEONARD A. SMITH, Chair (Adhesives, Coatings, Wood-based Composites), HANNA (Ultrastructure and Microscopy), HUSSEIN (Structural Engineering, Mechanics of Materials), KEULER (Construction Estimating, Safety, Codes and Zoning, CAD), KYANKA (Construction, Applied Mechanics, Engineering Design), MEYER (Wood Properties, Anatomy), SALGADO (Construction Management, Cost Engineering, Scheduling), W. SMITH (Wood Preservation and Seasoning).

Undergraduate Program

The wood products engineering program prepares students for a wide variety of professional careers in construction management, wood products manufacturing, marketing, or the use of wood as a material. These interests are presented in two options: construction, and wood products. Instruction is tailored to the interests of individual students through the use of electives taken at both ESF and Syracuse University.

Professional growth of students is stimulated by active membership in student chapters of professional organizations. Students are encouraged to join an organization that is of particular interest to them. The following student chapters are on campus: the Society of Wood Science and Technology, the Forest Products Research Society, and the Student Construction Association (affiliated with The Associated General Contractors of America and General Building Contractors).

To enter either option at the junior level, a transferring student must have acceptable college credit in the coursework areas listed below. Students who have completed a pre-calculus course, but have not completed chemistry and/or physics may apply for the five-semester program.

Construction Option

The commercial construction industry represents an important segment of the nation's GNP. A consequence of this economic importance is that the industry is very competitive. With more construction firms bidding on jobs, it is the organization with the best prepared professionals using the latest technology which usually is the successful bidder. This competition applies not only to contractors, but to others who are involved in construction operations; e.g., engineers, human resource managers, and material and equipment suppliers. People engaged in this industry must have state-of-the-art skills and knowledge to be suc-

Lower Division Courses[1]

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	Credit Hours
Written and Oral Communication	6-9
English Comprehension, Composition, Public Speaking, or Technical Writing	
Social Sciences	3-9
Economics, Sociology, Psychology, Ethics, or Human Relations	
Mathematics—Calculus I and II	6
Chemistry I with Laboratory	4
Physics I with Laboratory	4
Liberal Arts and Sciences	Up to 19
Philosophy, Art, History, Languages, Literature, Political Science, Biology, Geology, Statistics, or Computer Science	
Professional Studies	Up to 40
Design, Technology, Management, or Graphics	
Total minimum lower division credits	62

[1] Sophomores who wish to transfer with fewer than 62 credits should contact the Admissions Office.

cessful.

The construction option prepares students for management and engineering careers in the construction industry. The basic objectives of the construction option are twofold: first, to provide a fundamental understanding of the engineering considerations which comprise the facility design; and second, to demonstrate the various methods used to take the design into the field and produce a quality product in the most efficient and effective manner.

Particular attention is given to the study of engineering practices. Students learn the behavior of such construction materials as timber, steel, concrete, soil, and rock. Analysis and design of various structural functions are studied, including buildings, excavations, foundations, and waterfront structures. Courses include construction safety, construction equipment, light construction, construction methods, building codes and zoning, specifications, planning and scheduling, estimating, and construction management.

Quality, economic use, and behavior of the materials are stressed throughout the curriculum. Legal and social aspects are integrated into the program in the later stages.

Graduates of the construction option are well prepared for careers in a very challenging and dynamic field. Positions held by alumni include:

- Construction Manager
- Project Manager
- Project Engineer
- Cost Engineer
- Construction Engineer
- Field Engineer
- Planning/Scheduling Engineer
- Timber Engineer
- Truss Design Engineer

Students may complete this option in four or five semesters.

Wood Products Option

Students selecting this option may elect a concentration in marketing/production management, or wood science. These elective concentrations build upon a core set of courses designed to develop a comprehensive knowledge and understanding of wood and wood products. Students meet individually with their faculty advisors to discuss their career goals and prepare a study plan. Students may complete this option in four or five semesters.

Marketing/production management. Students choosing this elective concentration select courses from ESF and Syracuse University's School of Management. They usually intend to enter the purchasing, marketing, or cost analysis fields. Job titles of recent graduates include:

- Export Trade Analyst
- Technical Sales Representative
- Marketing Research Analyst

An understanding of the material properties of wood and the suitability of specific wood species for use in various products enables graduates with a marketing/production management concentration to assist customers in the selection of the correct wood product for the intended end use, or to advise on the procurement of the best wood raw material for manufacturing operations. The issues involved include, for example, considering the correct species of wood, treatments to prolong the service life of a wood product, and selection of the most suitable manufactured product for a specific application. A special knowledge of the material properties of wood, its durability, behavior under various conditions of temperature and relative humidity, and the characteristics of different species and types provides graduates with the ability to make sound judgements on the various parameters involved in the manufacture and use of wood products. Job titles of recent graduates include:

- Quality Control Engineer
- Plant Engineer
- Production Supervisor

Wood science. This elective concentration focuses on the technology and scientific disciplines required for an intimate understanding of wood use, including chemistry, physics, plant anatomy, and engineering. At ESF, this elective concentration prepares students for careers in technical services, product development, and graduate study leading to teaching or research at the university level. Graduates who pursue a technical service career use their knowledge of wood to enhance the efficiency of operations in chemical or machined manufacturing, or consult with industry in technical fields such as lumber production, preservative treatment, or panel production. Those students who choose wood science select biological, chemical, and/or physical science courses at ESF and Syracuse University. Advanced courses in wood science and wood technology are also available.

Wood science uses materials science and engineering to increase the efficiency of wood, apply existing or new knowledge to wood product manufacturing and utilization, or to conduct the re-

(Cont. p. 123)

Upper Division Courses

Construction Option
4-Semester Sequence

Junior Year — *Credit Hours*

Fall Semester	ESF	332	Seminar for New Transfer Students	0
	ERE	221	Engineering Mechanics-Statics	3
	ERE	371	Surveying	3
	WPE	342	Light Construction	3
	WPE	387	Wood Structure and Properties	3
	Elective			3
				15
Spring Semester	APM	391	Statistical Analysis	3
	ERE	362	Mechanics of Materials	3
	ERE	364	Engineering Materials	3
	WPE	343	Construction Estimating	3
	General Elective[1]			6
				18
Summer	WPE 399		Field Trip	1

Senior Year — *Credit Hours*

Fall Semester	CIE	337	Soil Mechanics I	3
	FEG	410	Structures	4
	WPE	350	Construction Methods and Equipment	3
	WPE	453	Construction Planning and Scheduling	3
	WPE	497	Senior Seminar	2
				15
Spring Semester	WPE	454	Construction Project Management	3
	WPE	455	Construction Contracts and Specifications	3
	Construction Technical Elective[2]			3
	General Elective[1]			3
	Wood Technical Elective[3]			3
				15

Construction Option
5-Semester Sequence

Junior Year — *Credit Hours*

Fall Semester	ESF	332	Seminar for New Transfer Students	0
	MAT	295	Calculus I	3
	PHY	103	Physics I	4
	WPE	342	Light Construction	3
	WPE	387	Wood Structure and Properties	3
	General Elective[1]			3
				16
Spring Semester	APM	391	Statistical Analysis	3
	MAT	296	Calculus II	3
	WPE	343	Construction Estimating	3
	Elective/Computer			3
	General Elective[1]			3
				15
Summer	WPE 399		Field Trip	1

Senior Year

				Credit Hours
Fall Semester	CHE	106	General Chemistry	3
	CHE	116	General Chemistry Lab	1
	ERE	221	Engineering Mechanics-Static	3
	ERE	371	Surveying	3
	WPE	453	Construction Planning and Scheduling	3
	WPE	350	Construction Methods and Equipment	3
				16
Spring Semester	ERE	362	Mechanics of Materials	3
	ERE	364	Engineering Materials	3
	WPE	454	Construction Project Management	3
	WPE	455	Construction Contracts and Specifications	3
	Wood Technical Elective[3]			3
				15
Fall Semester	CIE	337	Soil Mechanics I	3
	FEG	410	Structures	4
	WPE	497	Senior Seminar	2
	Construction Technical Elective[2]			3
	Elective			3
				15

[1] *General Electives:* FOR 205 Introduction to Macroeconomics, FOR 206 Introduction to Microeconomics, FOR 461 Management Models, WPE 401 Creative Approaches to Management. Additional courses in liberal arts and sciences may be required.

[2] *Construction Technical Electives:* CIE 332 Structures II, CIE 338 Soil Mechanics II, WPE 330 Building Codes and Zoning Practices, WPE 332 Mechanical and Electrical Equipment, WPE 335 Cost Engineering, WPE 404 Design of Wood Structure, WPE 413 Computer-Aided Senior Project, or WPE 414 Computer Applications in Engineering.

[3] *Wood Technical Electives:* WPE 326 Fluid Treatments, WPE 404 Design of Wood Structural Elements, WPE 420 Adhesives, Sealants and Coatings, WPE 422 Composite Materials.

A total of 126 credit hours is required to complete the B.S. degree in wood products engineering with the construction option.

Wood Products Option

4-Semester Sequence

Junior Year

				Credit Hours
Fall Semester	ESF	332	Seminar for New Transfer Students	0
	EFB	335	Dendrology	2
	ERE	221	Engineering Mechanics-Statics	3
	WPE	322	Mechanical Processing	3
	WPE	387	Wood Structure and Properties	3
	WPE	388	Wood and Fiber Identification Laboratory	2
	Elective			3
				16
Spring Semester	ERE	362	Mechanics of Materials	3
	WPE	326	Fluid Treatments	2
	WPE	327	Fluid Treatments Laboratory	1
	WPE	342	Light Construction	3
	Elective Concentration Course*			3
	Statistical Analysis			3
				15

Industrial Field Trip (a one-week field trip immediately following the final examination period):

WPE 399	Field Trip	1

Senior Year *Credit Hours*

Fall Semester	WPE	404	Design of Wood Structural Elements	3
	WPE	420	Adhesives, Sealants, and Coatings	3
	WPE	497	Senior Seminar	2
	Elective Concentration Courses*			6
	Elective Course			3
				17
Spring Semester	FOR	404	Economics of Wood-Using Industries	3
	WPE	422	Composite Materials	3
	Elective Concentration Courses*			6
	Elective Course			3
				15

Wood Products Option

5-Semester Sequence

Junior Year *Credit Hours*

Fsll Semester	ESF	332	Seminar for New Transfer Students	0
	CHE	106	General Chemistry	3
	CHE	116	General Chemistry Lab	1
	EFB	335	Dendrology	2
	MAT	295	Calculus I	3
	WPE	387	Wood Structure and Properties	3
	WPE	388	Wood & Fiber Identification Lab	2
				14
Spring Semester	MAT	296	Calculus II	3
	PHY	211	General Physics	3
	PHY	221	General Physics Lab	1
	WPE	326	Fluid Treatments	3
	WPE	327	Fluid Treatments Lab	1
	WPE	342	Light Construction	3
	Elective Course			3
				17

Industrial Field Trip (a one-week field trip immediately following the final examination period):

	WPE	399	Field Trip	1

Senior Year *Credit Hours*

Fall Semester	ERE	221	Engineering Mechanics-Statics	3
	WPE	332	Mechanical Processing	3
	WPE	420	Adhesives, Sealants, and Coatings	3
	Elective Concentration Course*			3
	Elective Course			3
				15
Spring Semester	ERE	362	Mechanics of Materials	3
	FOR	404	Economics of Wood-Using Industries	3
	WPE	422	Composite Materials	3
	Elective Concentration Courses*			6
				15

Fall Semester	WPE 404	Design of Wood Structural Elements	3
	WPE 497	Senior Seminar	2
	Elective Concentration Course*		3
	Elective Courses		6
			14
	Total minimum upper division credits		65

A total of 126 credit hours is required to complete the B.S. degree in wood products engineering with the wood products option.

*At least 9 credit hours of elective concentration courses must be selected from an advisor-approved sequence of technical courses. Examples of acceptable courses include the following:

Marketing/Production Management
ACC 204 Financial Account Systems, FIN 355 Money and Banking, FIN 356 Corporation Finance, MAR 355 Marketing and Society, LPP 255 Introduction to the Legal System, O&M 346 Organizational Behavior, TDM 365 Transportation and Distribution Management, MAR 457 International Marketing Management, WPE 343 Construction Estimating, OPM 365 Management of Operations, OPM 464 Manufacturing Management System, OPM 465 Control of Operations. OPM 466 Operations Management and Systems Analysis, O&M 447 Management Policy

Wood Science
PHY 212 Physics II, CHE 116 Chemistry II, FCH 221 Organic Chemistry, FCH 571 Wood Chemistry, EFB 541 Wood Microbiology, ERE 496 Tropical Timbers

search and development required for new products, processes, and treatments. Job titles of recent graduates include:

- Applications Engineer
- Product Development Engineer
- Wood Products Technologist

Graduate Opportunities

Through the program in environmental and resource engineering, the Faculty of Wood Products Engineering participates in graduate education leading to the master of science and doctor of philosophy degrees.

The objective of the graduate program is to provide students with an understanding of the behavior of wood and composite materials made from wood. Areas of research are described in the section on Division of Engineering (p. 57). Students with backgrounds in such varied fields as wood technology, engineering, or biology can pursue graduate study in this field.

Research in progress in ultrastructure includes light and video microscopy of wood fracture to elucidate wood fracture mechanisms, strain field analysis of wood and paper, cellulose synthesis and the cytoskeleton, and intracellular communication (plasmadesmata, gap junctions). Current projects in the field of mechanics are focused on the dynamic and static response of wood and wood structures to various load conditions, and comparison of the duration of load of juvenile and mature wood. Other active research areas include wood biodegradation and preservation, expert systems relating wood properties to wood utilization, radio-frequency and dehumidification seasoning of wood, and tree growth-wood quality relations.

Laboratory facilities include a mechanical testing laboratory with a wide range of testing machines, electronic data acquisition facilities, shaker table and frequency analyzers, and complete wood processing facilities including a sawmill, plywood mill, dry kiln, and wood preservation equipment. One of the largest wood collections in the world (the H. P. Brown Memorial Wood Collection) is used to support the graduate research program of the Tropical Timber Information Center.

A complete microscopy laboratory is provided by the N. C. Brown Center for Ultrastructure Studies. This equipment includes transmission electron microscopes, scanning electron microscopes with energy dispersive x-ray analysis and particulate analysis accessories, and a wide variety of light microscopes equipped with image enhancement and various video image analysis capabilities. Graduate students using this equipment have superlative tools to relate macroscopic behavior of wood to its anatomical characteristics.

Course Offerings

COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY COURSE DESCRIPTIONS

The courses offered by the College are grouped by general subject areas, and the number of credit hours appears after the course title. A credit hour means one recitation (or lecture) hour per week. Three laboratory hours are equivalent to one lecture hour.

The semester(s) after each course indicates when it is normally offered. The College reserves the right to alter the scheduled offering of a course when its enrollment is too small, or when there is no qualified faculty member available to teach it.

Courses listed in this catalog are subject to change through normal academic channels. New courses, course deletions, and changes in courses are initiated by the cognizant Faculties or programs, approved by the appropriate academic dean, faculty committee, and the college faculty.

Course Numbering System

Code Levels:

100-499 Undergraduate courses for which no graduate credit may be given.

500-599 Graduate courses designed expressly for areas of specialization in post-baccalaureate programs or in the professional program leading to the Bachelor of Landscape Architecture. Qualified undergraduate students may enroll by permission of the instructor.

600-699 Graduate courses designed expressly for advanced levels of specialization. Undergraduate students with a cumulative grade point average of 3.000 or better may enroll in these courses with an approved petition.

700-999 Advanced graduate level courses for which no undergraduate students may register.
Shared resources courses, designated as 400/500 or 400/600, are designed when the topic coverage of both courses is the same. Separate course syllabuses are developed expressly differentiating the requirements and evaluative criteria between the undergraduate course and the graduate course.

General Subject Areas

APM—APPLIED MATHEMATICS

APM 153. Computing Methods for Engineers and Physical Scientists .... (3)
Introduction to programming structures: flowcharts, language statements, and subprograms. Introduction to data structures: arrays, scalars, and others. Introduction to data codes: numbers and characters, "natural" and binary. Introduction to algorithms at the procedural level.

APM 155. Computing Methods for Foresters and Biologists (3)
Introduction to computing resources: mainframe and personal computers. Introduction to computing: computing mechanisms, data representations, and sources of computation error. Introduction to applications computing: word processing, spreadsheets, communications/electronic mail, computer graphics, and geographic information systems.

APM 205. Topics in Integral Calculus .... (3)
Three hours of lecture and recitation covering the fundamentals of integral calculus and associated topics of analytic geometry. Fall.
Prerequisite: Calculus I.

APM 360. Introduction to Computer Programming .... (3)
The basic course in computer programming offered by the College. It is intended to provide the student with the skill and understanding needed to utilize digital computer languages for problem solving. The course will cover instruction in Fortran and an introduction to APL; cursory use of operating systems; and some background material in general hardware/software designs. Fall and Spring.

APM 391. Introduction to Probability and Statistics .... (3)
Elementary probability including permutations, combinations, and other counting formulae, and basic statistical inference, including point estimation, confidence intervals, and hypothesis testing for one or two population means or proportions.

APM 395. Probability and Statistics for Engineers .... (3)
Elementary probability including permutations, combinations, and other counting formulae, and basic statistical inference, including point estimation, confidence intervals, and hypothesis testing for one or two population means or proportions.
Prerequisite: Calculus through integral calculus.

APM 492. Forest Biometrics .... (3)
Two hours of lecture, three hours of laboratory. Analysis of variance including nested and cross-classification. Matrix approach to multiple linear regression and weighted least squares. Nonlinear regression. Sampling methods and design. Applications to forestry problems. Fall.
Prerequisite: APM 391 or equivalent.

APM 500. Introduction to Computer Programming for Graduate Students .... (3)
A basic course in computer usage. Provides the skill needed to utilize digital computer languages for problem solving. Includes a study of Fortran with a discussion of APL and Assembly Language. Other topics include representation of information, management of files, error control, operational systems and job control.

APM 510. Statistical Analysis .... (3)
Two hours of lecture and three hours of laboratory. A treatment of statistical inference, including paired design, group design, linear regression and correlation, one way analysis of variance and some applications of chi-square. Calculation of statistics, test of hypotheses and proper inter-

pretation of calculated statistics. Fall.

APM 620. Analysis of Variance .... (3)
Three hours of lecture and recitation and three hours of laboratory. Multiway classifications in the analysis of variance, with emphasis on the development of models, including randomized blocks, latin squares, split plots, and factorial designs with fixed effects, random effects, and mixed effects; multiple and partial regression and correlation (including curvilinear), using matrix methods; analysis of covariance. Fall.
Prerequisites: Graduate standing and an introductory course in statistics covering material through the one-way analysis of variance.

APM 625. Introduction to Sampling Techniques .... (3)
Two hours of lecture and three hours of laboratory. Introduction to the scientific basis of sampling: selecting an appropriate sampling unit; choosing an efficient design; calculating sampling error; determining a sample size to meet stated objectives. Fall.
Prerequisite: APM 391 or equivalent.

APM 630. Regression Techniques with Applications to Forestry .... (3)
Two one and one-half hours of lecture. Review of matrix algebra, probability theory and statistical methods. Basic concepts in regression analysis. Classical linear regression model. Least and weighted least squares method. Dummy variables and their uses in regression and covariance analysis. Applications to problems of statistical prediction and estimation from the field of forestry in general and forest mensuration and inventory in particular. Fall.
Prerequisite: APM 391 or equivalent.

APM 635. Multivariate Statistical Methods .... (3)
Estimation and inference for the multivariate normal distribution. Multivariate analysis of variances, factor analysis, principal components analysis, canonical correlation, discriminate analysis, cluster analysis. Spring.
Prerequisite: One semester of statistics.

APM 640. Mathematical Modeling of Environmental Systems .... (3)
Three hours lecture/discussion. This course provides students with skills to develop and apply mathematical models of environmental fate processes, perform analyses of sensitivity and uncertainty to facilitate model selection, parameter estimation, and experimental design, and assess the role of mathematical modeling in relation to other aspects of environmental systems analysis and management. Fall.
Prerequisites: Calculus through integral calculus, introductory probability and statistics, introductory differential equations, and knowledge of a programming language.

APM 650. Operations Research .... (3)
Two one and one-half hours of lectures. Deterministic and Stochastic Operations Research models applicable to managerial problems. Linear programming, transportation and allocation models, goal programming, dynamic programming, network analysis, and simulation techniques. Spring.
Prerequisites: APM 391 and MAT 227 or equivalent, or permission of the instructor.

APM 696. Special Topics in Quantitative Methods .... (1-3)
Experimental and developmental courses in areas of quantitative methods not covered in regularly scheduled courses. A course syllabus will be available to students and faculty advisors prior to registration.

CMN—COMMUNICATIONS (LANDSCAPE ARCHITECTURE)
(See also courses listed below under EIN and LSA.)

CMN 310. Computer Applications for Professional Communications .... (3)
Three hours of lecture and discussion. An introductory course in environmental data sources and computer applications useful for information processing and communication. Fall and spring.

CMN 380. Technical Drawing I .... (1)
One three-hour drafting room period. Elements of perspective, isometric, oblique, and orthographic projection. Practice in freehand and instrument drawing. Fall.

CMN 381. Technical Drawing II .... (2)
Two three-hour drafting room periods. Elements of perspective, isometric, oblique, and orthographic projection. Practical applications of these principles in machine and architectural drawing, including piping and electrical drawings. Spring.

CMN 382. Graphic Communication .... (3)
Two three-hour studios and one one-hour lecture per week. Studio time devoted to demonstrations, exercises, and projects. Focusing on sketching, drafting, drawing construction and rendering techniques used in the landscape architecture field. Emphasis on skill development, and use of graphics in the design process. Drawings, examinations, and actual project constitute basis for grades. Fall.

CMN 410. Writing for Environmental Professionals .... (3)
Three hours of lecture and discussion. Principles and practice of writing skills required of environmental professionals. Develop proficiency in determining the purpose of a document; analyzing the audience; selecting, developing, and organizing the information in an appropriate design; and writing clearly, precisely, and effectively. Writing assignments are made weekly; rewriting is routinely required. Fall and spring.
Prerequisite: Satisfactory completion of a college-level course in basic writing skills.

CMN 530. Environmental Communications Studio .... (2)
Three-hour studio and one-hour discussion. For seniors and graduate students, this course offers the opportunity for students to apply communications theory and strategies through the planning, production, and display of media projects developed around the student's area of professional interest. Enrollment limited to 20 students. Fall.
Prerequisite: CMN 531 or permission of the instructor.

CMN 531. Environmental Communications .... (3)
Three hours of lecture/discussion. An introductory course for seniors
and graduate students which presents techniques and processes in education and communications applicable in environmental science, management, planning, and design. Topics incude basic teaching, learning and communications theory and strategy, working with the press, electronic media, gaming and simulation, public address techniques, slide/tape production and use, film production and use. Spring.

CMN 552. Graphic Communication .... (3)
Two three-hour studios and one one-hour lecture per week. Studio time devoted to demonstrations, exercises and projects focusing on sketching, drafting, drawing construction and rendering techniques used in the landscape architecture field. Introduction to drawing reproduction and technologies. Emphasis on skill development, use of graphics in the design process. Drawings, examinations, and a final project constitute basis for grades. Fall.
Prerequisite: M.L.A. status or permission of the instructor.

CMN 637. Environmental Communications Project .... (1-3)
This course is designed to give graduate students an opportunity to work as a team in identifying, developing, administer-

ing, and evaluating a communications project related to an environmental issue. Typically, a workshop or shortcourse will be developed and offered for some targeted public through the School of Continuing Education. The nature of the topic and format of the project will be determined according to experiences enrolled. Task responsibilities and time commitments are correlated with number of hours for which student has registered. Spring.

CMN 682. Video Communications ....(3)
Three hours of studio plus lecture. This course will provide students with instruction and experience in the skills necessary to provide video tape programs. Each student will prepare and develop a video script for production of a program on an assigned topic. Completed programs will be tested and evaluated. Class size is limited. Fall and Spring.
Prerequisite: Permission of the instructor.

CMN 738. Environmental Education Programs of Agencies and Institution ....(1-3)
One three-hour seminar session. An analysis of contemporary environmental education objectives, methodologies, and philosophies employed by various public and private institutions. Attendance, readings, and short paper required for one-hour credit. For two or three hours credit, an individual investigation of the environmental education and communications activity of an agency or organization is also required. Fall.

EFB—ENVIRONMENTAL AND FOREST BIOLOGY

The Faculty of Environmental and Forest Biology offers a diverse array of courses at both undergraduate and graduate levels. Based on student interest, curricula can be designed to accommodate a degree of specialization in one or more subdisciplines of biology. In the following list, courses numbered from ( )00 - ( )25 (at each level) are General Biology offerings; those from ( )26 - ( )50 are Plant Sciences, and those from ( )51 - ( )95 are Animal Science courses.

NOTE: All EFB courses of 300 level and above require a minimum prerequisite of one year of college biology or equivalent. A course at an appropriate level may be taken with permission of the instructor.

EFB 226. General Botany ....(4)
Three hours of lecture and three-hour laboratory. An introduction to plant biology with special emphasis on the structure and function of the green plant. Fall.

EFB 285. Principles of Zoology ....(4)
An introduction to the study of vertebrate and invertebrate animals, including reproduction, development, heredity, physiology, form and function, diversity, evolution, and behavior. An integrated laboratory and lecture course that introduces processes of scientific inquiry and provides a basis for understanding the natural world. The course provides the fundamental background for advanced or specialized courses, e.g., in animal physiology, anatomy, taxonomy, ecology, behavior, and fisheries/wildlife sciences.

EFB 303. Introductory Environmental Microbiology ....(4)
Three hours of lecture and three hours of laboratory. An introduction to the biology of microorganisms and viruses and a study of their interactions with other microbes and macroorganisms. Fall.

EFB 307. Principles of Genetics ....(3)
Three hours of lecture and discussion. A general course covering concepts of genetics and evolution basic to upper division biology and biochemistry courses. Includes the inheritance and analysis of Mendelian and quantitative traits, the chemical nature of the gene and its action, genetic engineering, the genetic structure of populations and their evolution. Numerical methods for the characterizing and analyzing genetic data are introduced. Spring.
Prerequisite: A one-year college introductory biology course.

EFB 308. Principles of Genetics Laboratory ...(1)
Three hours of auto-tutorial laboratory. Experiments with plant and animals and computer simulation exercises demonstrate the basic principles of inheritance of Mendelian traits and changes in populations caused by major forces in evolution or by breeding procedures. Numerical methods for characterizing quantitative traits and for testing hypotheses are introduced. Spring.
Corequisite: EFB 307 or equivalent.

EFB 309. Introduction to Quantitative and Population Genetics ....(1)
Lectures and auto-tutorial laboratories the latter half of the semester of EFB 307 and 308. Basic genetic concepts of quantitative inheritance, the structure of populations, and evolution. Laboratory experiments and computer simulations are used to demonstrate these concepts. Numerical methods for characterizing and analyzing genetic data are introduced. Not open to students taking EFB 307 and 308. Spring.
Prerequisite: An introductory genetics lecture-laboratory course deficient in these areas of genetics and permission of the instructor.

EFB 320. General Ecology ....(3)
Two hours of lecture, three hours of field trips during the first half of the semester. Introduction to ecosystem ecology stressing the dynamic interrelationships of plant and animal communities with their environments ecological factors, energy flow and trophic levels in natural communities, plant responses and animal behavior, population dynamics, biogeography, and representative ecosystems. The ecological impact of man is reviewed.
Fall.

EFB 325. Cell Physiology ....(3)
Three hours of lecture. Introduction to the dynamics of living systems with emphasis on the universality of the biological world. Spring.
Prerequisite: One semester of organic chemistry.

EFB 326. Diversity of Plants ....(3)
Two hours of lecture and one three-hour laboratory. An evolutionary survey of plants from unicellular prokaryotes to multicellular eukaryotes. Coverage includes the algae, fungi, bryophytes, lower vascular plants, ferns, gymnosperms and angiosperms. Spring.
Prerequisites: EFB 226 or general biology.

EFB 335. Dendrology ....(2)
One hour of lecture and one three-hour laboratory/field trip. Field study, identification, and major characteristics of important forest trees of North America. Open only to students in the Forest Engineering curriculum. Fall.

EFB 336. Dendrology ....(3)
Two hours of lecture and one three-hour laboratory/field trip. Field study, identification, natural history, and elementary silvics of important forest trees of North America. Fall.

EFB 340. Forest and Shade Tree Pathology ....(3)
Two hours of lecture and three hours of autotutorial laboratory. Major diseases of forest, shade, and ornamental trees and deterioration of forest products, with emphasis on disease identification, principles of disease development, effects of disease on the host, and practical control measures. Spring.

EFB 351. Principles of Forest Entomology ....(3)
Two hours of lecture, three hours of laboratory. Elements of insect classification, morphology and physiology; introduction to the role of insects in forested ecosystems; insect surveys, hazard rating, impact, control and other aspects of

applied forest pest management. Designed for students in Resources Management. Spring.

EFB 352. Elements of Entomology ....(3)
Two hours of lecture, three hours of laboratory/field work. General classification of insects, morphology, physiology, ecology, behavior, and basic principles of population control. Emphasis through illustration is on the role of insects in the forest environment. Fall.

EFB 355. Invertebrate Zoology ....(4)
Three hours of lecture, three hours of laboratory. Structure, function, classification, and evolution of invertebrates. Emphasis on functional biology and ecological interactions. Fall.

EFB 382. Wildlife Conservation ....(3)
Two hours of lecture, one hour of recitation. Introduction to the biological principles of conservation including the relationship of natural resources to modern society. The wildlife resource and its conservation will be emphasized. It is not designed for students concentrating in the area of Forest Wildlife Management. Fall.

EFB 385. Comparative Vertebrate Anatomy ....(4)
Three hours of lecture and three hours of laboratory per week. Analysis of vertebrate structure, with emphasis on comparative study of organ systems. Includes evolution of form and function, major adaptive patterns, and phylogenetic relationships in vertebrates. Spring.

EFB 386. Vertebrate Histology ....(3)
Two hours of lecture and three hours of laboratory. A study of tissues from protochordates, fishes, amphibians, reptiles, birds, and mammals, with emphasis on evolution, environment, and function, and with introduction to histopathologies. Spring.

EFB 405. History of the Natural Sciences/Contemporary Issues ....(2)
Two hours of lecture. A review of the history of western science from pre-Ionian to Darwin, with evaluation of the impact of cultures and theology on the progress of scientific thought. Contemporary issues conceming bioethics and biotechnology will be examined for their influence on the scientific community and social structure. Spring.

EFB 410. Concepts in Evolution and Biological Systematics (3)
Three hours of lecture. Exploration of the core concepts of evolutionary and systematic biology to better understand organic diversity. Includes study of evolution's causal factors (mutation, migration, drift, and natural selection) and results (microevolution, differentiation, speciation and macroevolution) as well as the principles that allow classification of living organisms and reconstruction of evolutionary histories. Examples are drawn from plants, animals, and microorganisms. Spring.
Prerequisitie: Genetics.

EFB 412. Introduction to Chemical Ecology.....(3)
Three hours of lecture with discussion. Centers on chemical signals among organisms from microbes to man as they affect ecology, physiology and behavior and as they can be utilized for agriculture, pest management, and animal husbandry.
Prerequisites: Biology (one year), organic chemistry (one year).
Note: Also listed as FCH 440.

EFB 415. Ecological Biogeochemistry ....(3)
Three hours of lecture and discussion. Investigation of the principles of biogeochemistry in ecosystems. The transformations and fluxes of elements in terrestrial and aquatic ecosystems including global cycles are emphasized. Fall.
Prerequisites: Courses in general ecology and introductory chemistry.

EFB 420. Field Experience Internship ....(5)
Full-time for at least five weeks, or equivalent, of employment withan agency or professional involved in field activity. A resident faculty member is required to serve as course evaluator. Approval of curriculum director is necessary. See advisor for detailed procedural information. Summer.

EFB 421. Ecology of Freshwaters ....(2)
Half-time for four weeks. Cranberry Lake Biological Station. Experimental and observational studies of environmental and biotic interactions influencing productivity of freshwaters. Basic concepts at the organismic, population, and community level. Summer.

EFB 426. Plant Propagation ....(1)
One combined lecture-demonstration laboratory plus supervised greenhouse assignments. Instruction in principles and practices of plant propagation and in related greenhouse operations. Fall and Spring.
Prerequisite: Senior status in Environmental and Forest Biology curriculum.
Note: Cannot be used to satisfy the 6-hour biology curriculum requirement in the plant sciences.

EFB 435. Adirondack Flora .... (2.5)
Field study of summer flora of the Adirondacks including field identification and ecology of key species.

EFB 436. Dendrology II ....(1)
One three-hour field trip/laboratory. A continuation of Dendrology I emphasizing trees and shrubs ecologically important in the Central New York region and economically important in North America. Fall.

EFB 440. Mycology ....(3)
Two hours of lecture, three hours of laboratory. Fundamentals of the morphology, taxonomy, life histories, ecology and symbiotic relationships of fungi.

EFB 441. Field Plant Pathology ....(2.5)
Field study of plant diseases and decline with special emphasis on the field identification of different pathogens, including viruses, bacteria, fungi, insects, and pathogenic plants.

EFB 442. Field Mycology ....(2.5)
An introduction to the collection and identification of Adirondack fungi. Field techniques and laboratory identification of the major fungi found in selected ecosystems.

EFB 443. Plant Virology ....(3)
Two hours of lecture and three hours of laboratory. History of plant virology, identification and characterization of plant viruses, including transmission mechanisms, vector relationships, purification, and serology. Laboratory will present techniques for the identification and characterization of plant viruses. Spring (even years).
Prerequisite: EFB 303, equivalent, or consent of the instructor.

EFB 445. Plant Ecology.....................................(3)
Two hours of lecture and discussion and one laboratory session. A first course in plant community ecology dealing with the dynamics of community development and change and the process of community analysis and description. Spring.
Prerequisite: EFB320.

EFB 448. Physiological Ecology of Plants ....(3)
Three hours of lecture. Examination of the interactions between plants and their environment. Emphasis will be given to the physiology of plants as it is modified by fluctuating external conditions and the mechanisms of plant adaptation. Students completing EFB 448 should not enroll in EFB 330. Fall.
Prerequisites: An introductory course in physics, EFB 320 and EFB 326.

EFB 451. Pest Management Theory and Practice ....(2)
Two hours of lecture for nine weeks; then one lecture hour and one three-hour laboratory for four weeks. A review of history and govern-ental policy for four weeks. A review of history and govern-

mental policy of pest management, as well as basic instruction in theory and practicum.
Prerequisite: EFB 352 or equivalent.

EFB 452. Principles of Chemical Control........(3)
Two hours of lecture; one three-hour laboratory. A study of the chemistry, toxicology, handling and application of chemicals used to manage pest populations. A primer for the State Pesticide Application examinations. Spring.
Prerequisite: EFB 451.

EFB 453. Forest and Aquatic Insects ....(2)
The forest and aquatic insects of Cranberry Lake Region and their role in these environments and habitats. Insect collection required. Summer.

EFB 454. Wood Deterioration by Insects ....(3)
Three hours of lecture, discussion, and demonstration. Biology, identification, ecology of insect and wood interrelations; prevention of injury and control of insects injurious to forest products and wood in use. Spring.
Prerequisite: EFB 352 or equivalent.

EFB 476. Vertebrate Ecology ....(2.5)
Utilization of unique Adirondack forms and communities to study population dynamics, behavior, systematics, and the ecological role of vertebrates; standard field and laboratory techniques.

EFB 478. Microcommunity Ecology ....(2.5)
Field study of terrestrial invertebrate microcommunities; descriptive and comparative assay of microhabitats incorporating experimental and field techniques. Summer.

EFB 479. Field Ornithology ....(2.5)
Field study of the ecology, distribution, and behavior of birds in the Adirondack region. Techniques used in conducting field studies in avian biology will be emphasized (including mist netting, banding, field identification, and avian censusing).

EFB 480. Principles of Animal Behavior ....(4)
Three hours of lecture, one hour of recitation per week. A study of the basic principles of animal behavior, stressing exogenous and endogenous mechanisms of control, with emphasis on the evolution of behavior. Spring.

EFB 481. Behavioral Ecology ....(2.5)
Study of the behavioral adaptations of animals to their environment. Emphasis will be placed on field observation and experimentation. Habitat selection, foraging, mating, and social behavior will be considered.
Prerequisite: EFB 480 Principles of Animal Behavior or equivalent behavior course.

EFB 483. Biology of Birds and Mammals ....(4)
A course surveying the taxonomy, anatomical-behavioral-physiological adaptations and natural history of birds and mammals. Techniques for the field study of a vertebrate species will be discussed. Fall.

EFB 485. Herpetology ....(3)
Two hours of lecture and three hours of laboratory. An introduction to the structure, function, ecology, behavior, development, and distribution of amphibians and reptiles as they relate to the systematics of the various groups. Spring.

EFB 486. Ichthyology ....(3)
Two hours of lecture, three hours of laboratory. An introduction to the anatomy, physiology, ecology, behavior, and taxonomy of fishes. Spring.

EFB 487. Fishery Biology ....(4)
Three hours of lecture and three hours of laboratory. Introduction to models of growth, mortality, production, and exploitation; aspects of fish ecology and behavior related to the dynamics and management of fish populations. Fall.
Prerequisite: EFB 486 or equivalent.

EFB 488. Ecology of Adirondack Fishes ....(2.5)
Study of the ecology of fishes, with detailed individual investigation of the ecology of Adirondack fishes.

EFB 489. Animal Physiology ....(4)
Three hours of lecture and three hours of laboratory per week. An introduction to the fundamentals of animal physiology, including function of the basic organ systems, organismal and physiological adaptation to the environment. Fall.
Prerequisites: General zoology (EFB 285 or equivalent), and either one semester of biochemistry or cell physiology (EFB 325 or equivalent).

EFB 490. Wildlife Ecology and Management ....(3)
Three hours of lecture. A study of the ecological principles governing wild animal populations and their habitats and the relationship of these principles to management programs and decisions. Spring.
Prerequisites: EFB 320 or equivalent.

EFB 491. Wildlife Ecology and Management Practicum .....(2)
One hour discussion, three hours laboratory. Practical contact and
experience with wildlife management techniques and programs; relates practices to principles of management. Designed for biology students wishing to pursue careers as wildlife biologists. Spring.
Corequisite: EFB 490; *Pre- or corequisite:* LIB 300.

EFB 492. Seminar in Ecology ....(1)
One hour of presentations and discussion. A topic in ecology will be emphasized and its importance to contemporary environmental issues will be addressed. Spring.
Prerequisite: 90 credit hours; Introductory course in ecology.

EFB 493. Wildlife Habitats and Populations ....(4)
Three hours of lecture/discussion and one three-hour laboratory per week, one Saturday field trip required. Application of ecological concepts including succession and population biology to wildlife management planning and program assessment. Students are exposed to U.S. Fish and Wildlife Service habitat evaluation procedures and fundamentals of population modeling. Fall.
Prerequisite: EFB 490/491, or graduate student standing.

EFB 496. Topics in Environmental and Forest Biology ...(1-3)
Experimental, interdisciplinary, or special coursework in biology for undergraduate students. Subject matter and method of presentation varies from semester to semester. May be repeated for additional credit. Fall or Spring.

EFB 497. Seminar ....(1)
One hour of presentations and discussion. A topic in Environmentaland Forest Biology will be emphasized and its importance to contemporaryissues will be addressed. Fall or Spring.
Prerequisite: 90 credit hours.

EFB 498. Research Problems in Environmental and Forest Biology ....(1-3)
Independent research in topics in Forest Biology for the superior undergraduate student. Selection of subject area determined by the student in conference with appropriate faculty member. Tutorial conferences, discussions and critiques scheduled as necessary. Final written report required for departmental record. Fall, Spring, and/or Summer.

EFB 500. Forest Biology Field Trip ....(1-3)
A five- to ten-day trip to (1) agencies engaged in biological research, management, and administration, or (2) regions or areas of unusual biological interest. A final report is required. Estimated student expense, $75. Fall or Spring.

EFB 501. Introduction to Genetic Engineering .(3)
Three hours of lectures. The concepts and processes of recombinant DNA technology for the manipulation of genomes of plants, animals, fungi, and bacteria to produce new organisms of practical value. Spring.

EFB 505. Microbial Ecology ....(3)
Two hours of lecture and three hours of laboratory. Applied and environmental aspects of microbiology with emphasis on biochemical interactions. Examining microbial processes and interrelationships in aquatic and terrestrial ecosystems. Spring.

EFB 510. Health and Our Chemical Environment ....(3)
Three hours of lecture and discussion. Analysis of our chemical environment and discussion of health hazards of anthropogenic and natural chemicals in environment associated with typical life styles of our society. Emphasis is on basic toxicological principles, scientific basis of regulations and risk assessment for balanced judgment of issues on health hazards of environmental chemicals.

EFB 515. Population Ecology ....(3)
Two hours of lecture and three hours of laboratory. Description, analysis, evolution, interactions and stability of natural and experimental populations. Spring.
Prerequisite: EFB 320 or equivalent.

EFB 518. Systems Ecology ....(4)
Three hours of lecture and three hours of laboratory/field experience. Survey of history, literature, and techniques of systems ecology, including, especially, the teaching of intellectual, basic mathematical, and computer skills that allow the student to take an environmental problem of his orher choosing and simulate it on a computer. Fall.
Prerequisites: One course in ecology. It is also recommended that the student have at least some previous or concurrent experience with computers. Weekend field trip required.

EFB 520. Pest Management Systems in Forestry ....(3)
An in-depth analysis of management systems developed for forest pest problems. This course examines the concepts and processes of integrated pest management systems in forestry. It analyzes the major forest insect and disease systems developed in recent years. Vegetation management and pesticide use in forestry are also covered. A forest management plan is prepared and defended according to preestablished guidelines. The course is required for the Master of Forestry degree and is part of a sequence of Forest Entomology, Pest Management, and Forest Pathology courses offered. Spring.
Prerequisites: EFB 351/352 or basic entomology; or forest pathology.

EFB 524. Limnology ....(3)
Three hours of lecture. An introduction to the physics, chemistry, andbiology of inland waters, with particular emphasis on lakes. The course focuses on lakes as integrated ecosystems, and analyzes perturbations in this environment on the structure and function of the biological communities contained therein. Fall.
Prerequisites:: Introductory courses in physics and chemistry, and EFB 320.

EFB 525. Limnology Laboratory ....(1)
One laboratory or field trip. An introduction to limnological techniques and the procedures for empirically analyzing ecological relations in aquatic ecosystems. Field trips to local aquatic habitats. Fall.
Co- or Prerequisite: EFB 524.

EFB 526. Introduction to Plant Tissue Culture ....(3)
One hour of lecture and six hours of laboratory designed to introduce students to the scientific and commercial uses of plant tissue culture.
Prerequisite: A semester of General Botany or equivalent.

EFB 529. Ecology of the Soil Plant System.....(3)
Three hours of lecture and discussion. The course develops the foundations of and understanding in soilplant relationships with emphasis on soil nutrients and trace elements. Role of the nutritional factor in population abundance and distribution, competition, allelopathy, species endemism, community development (succession), and anthropogenic factors are covered.
Prerequisites: EFB 320, or EFB 445, or equivalent.

EFB 530. Plant Physiology ....(3)
Three hours of lecture. Internal processes and conditions in higher plants with emphasis on physiological and biochemical concepts. For students majoring in the biological sciences. Spring.
Prerequisites: EFB 325, EFB 326.
Note: EFB 531 also required for Plant Sciences Concentration students.

EFB 531. Plant Physiology Laboratory ....(2)
Two laboratory sessions. Introduction to methods and procedures of physiological research. Spring.
Prerequisites: Co-requisite EFB 530, or permission of the instructor.

EFB 532. Plant Anatomy ....(3)
Two hours of lecture and three hours of laboratory. An introductory course in plant anatomy designed to familiarize the student with the organization and development of the primary and secondary plant body of higher plants. Spring.
Prerequisite: EFB 326.

EFB 535. Systematic Botany ....(3)
Two hours of lecture and three hours of laboratory. Identification, nomenclature, and classification of flowering plants with special emphasis on local flora and on developing the ability to classify the plants of any region. Fall.
Prerequisites: EFB 326, EFB 327.

EFB 541. Wood Microbiology ....(3)
Two hours of lecture and three hours of laboratory/field trip. Survey of lignicolous microorganisms, their roles in the degradation of wood, and principles of their control. Detailed consideration of all types of decay of wood and its products from chemical, ultrastructural, biotechnological and ecological perspectives. Fall.

EFB 542. Freshwater Wetland Ecosystems ....(3)
Three hours of lecture. An examination of the structure and function of various freshwater wetlands. Ecologic principles that broadly apply to all wetland ecosystems are examined and contrasted with terrestrial systems. The effect of management activities on, and the management potential of, wetlands are also examined.
Prerequisite: EFB 320 or equivalent.

EFB 545. Forest Decline Concepts..........................(3)
Three hours of lecture/discussion per week. Environmental stress factors will be integrated into forest decline concept models using specific examples from forest pathology, forest entomology, ecology, resource management and current environmental topics. Fall.

EFB 551. Forest and Shade Tree Entomology ....(2)
Two hours of lecture. Important forest and shade tree insects, detection, evaluation, prevention, and control of their damage; their relation to silviculture and management of forests and shade trees. Spring.
Prerequisite: EFB 352 or equivalent.

EFB 552. Forest and Shade Tree Entomology Laboratory ..(1)
Three hours of laboratory/field trip. Identification of important forest
and shade tree insects and their damage. Spring.
Pre- or Corequisite: EFB 551.

EFB 553. Biological Control.......................(2)
Two hours of lecture. Theory and practice of biological

control of insect pests and weeds. Emphasis on the ecology and utilization of major groups of predators, parasitoids, and pathogens used in pest management and interpretation of mortality. Fall (odd years).

Prerequisite: EFB 352 or equivalent.

EFB 554. Aquatic Entomology .... (3)
An introduction to the identification, life histories, and ecology of aquatic insects, with emphasis on genera found in the northeastern U.S. Includes a consideration of the functional role of insects in aquatic systems, and current avenues of research. Intended for seniors and graduate students pursuing interests in entomology, fisheries and wildlife, forestry, limnology and general ecology. Fall.

Prerequisite: One course in entomology or permission of the instructor.

EFB 560. Environmental Toxicology of Insecticides .... (3)
Two hours of lecture. Basis of action of insecticides in living systems, behavior of insecticides and microtoxicants in environment, interaction of insecticides and biological systems. Fall.

Prerequisite: EFB 325 or equivalent course in physiology or biochemistry.

EFB 561. Medical Entomology .... (3)
Three hours of lecture and recitation. Study of arthropods affecting man, domestic animals, and wildlife with emphasis on their biology, control, and relationships to vertebrate disease. Spring (even years).

Prerequisite: EFB 352 or equivalent.

EFB 565. Insect Morphology .... (3)
Two hours of lecture and three hours of laboratory. A comparative study of the external morphology of insects emphasizing evolutionary trends, especially modifications of homologous structures. Topics of special importance include intersegmental relationships, feeding, sensory mechanisms, locomotion, and reproduction. Spring.

Prerequisite: EFB 352.

EFB 570. Insect Physiology .... (3)
Two hours of lecture and three hours of laboratory. Study of the life processes in insects; introduction to modern physiological instrumentation and laboratory methods. Spring.

Prerequisite: EFB 325.

EFB 578. Terrestrial Community Ecology .... (3)
Three hours of lecture. Relation of terrestrial vertebrates and invertebrates to their physical, chemical, and biological environment. Emphasis on community principles, structural quantification, and evolutionary processes of terrestrial animals. Fall.

Prerequisite: EFB 320 or equivalent.

EFB 580. Wetland Wildlife Ecology and Management .... (3)
An assessment of important wildlife resources associated management within coastal and freshwater wetlands in North America. The course also covers state and federal wetland classification schemes, regulations, policy, and specific topics in wetland wildlife management.

EFB 590. Wilderness Wildlife Management .... (2.5)
The ecology, philosophy, and politics of wilderness wildlife management, including wilderness ecosystems, some field characteristics of Adirondack wilderness, and management of selected wilderness species.

Prerequisite: EFB 490, or equivalent introductory course in wildlife management.

EFB 601. Molecular Biology Techniques .... (3)
One hour of lecture and six hours of laboratory. Techniques used in molecular biology research are presented, including the extraction,
measurement, analysis, and manipulation of nuclear and organellar DNAs of plants and fungi. Some methods on RNA and proteins will be covered. Fall.

Prerequisites: FCH 530, 531, and 532.

EFB 602. Genetic Engineering of Eucaryotes ... (3)
Three hours of lecture. Genetic engineering of eucaryotic organisms with emphasis on plant and fungal systems. Principles and current research will be covered.

Prerequisites: EFB 407, FCH 530, and 532, or equivalent.

EFB 607. Breeding Plants for Resistance to Disease and Pests .... (2)
Two hours of lecture and discussion. Principles, methods, and strategies in breeding for resistance to diseases and pests. The effectiveness, durability, and limitations of resistance breeding in pest management and control are considered.

Prerequisites: Introductory courses in genetics or forest tree improvement and in forest pathology or entomology, or permission of the instructor.

EFB 610. Ecological Biogeochemistry .... (3)
Three hours of lecture and discussion. Investigation of the principles of biogeochemistry in ecosystems. The transformations and fluxes of elements in terrestrial and aquatic ecosystems including global cycles are emphasized. Fall.

Prerequisites: Courses in general ecology and introductory chemistry.

EFB 612. Introduction to Chemical Ecology .... (3)
Three hours of lecture with discussion. Centers on chemical signals among organisms from microbes to man as they affect ecology, physiology, and behavior and as they can be utilized for agriculture, pest management, and animal husbandry. This course is a companion to EFB 412/FCH 440.

EFB 625. Membranes and Biological Transport .... (3)
Two hours of lecture and one hour of discussion. Composition, structure, and physical properties of membranes. Membrane functions including transport, bioelectricity, and cell compartmentalization. Specific transport processes in biological systems. Fall (even years).

Prerequisites: One semester of biochemistry and an advanced physiology course.

EFB 630. Fungus Physiology .... (3)
Two hours of lecture and one hour of discussion. Principles of growth, reproduction, and differentiation of the fungi emphasizing the role of the environment in controlling fungal processes. Spring (even years).

Prerequisite: Two semesters of physiology or biochemistry.

EFB 632. Plant Growth Regulation .... (3)
Three hours of lecture/discussion on topics concerned with the biochemistry and physiology of plant hormones and synthetic growth regulators. Fall

Prerequisite: A course in plant physology or biochemistry.

EFB 633. Chemical Defenses of Plants .... (3)
Three hours of lecture/discussion about the ways in which plants defend themselves chemically against microorganisms, insects, herbivores, and other plants. Fall.

Prerequisite: A course in physiology or biochemistry.

EFB 635. Topics in Plant Nutrition .... (2)
Two hours of lecture, discussion, and seminars. Advanced course dealing with selected topics of mineral and organic nutrition of plants. Fall (odd years).

Prerequisites: Completion of one or more physiologically-oriented plant science courses.

EFB 640. Mycology .... (3)
Two hours of lecture, three hours of laboratory. Fundamentals of the morphology, taxonomy, life histories, ecology, and symbiotic relationships of fungi.

Corequisite: EFB 644.

EFB 641. Phytopathology .... (3)
Two hours of lecture and discussion and three hours of autotutorial laboratory. Principles and concepts of plant

pathology. Major diseases of ornamental plants, vegetable crops, fruit crops, field crops, and trees. This is an introductory plant pathology course for graduate students in all departments. Spring.

EFB 642. Epidemiology and Management of Tree Disease ....(3)
Three hours of lecture and discussion, with occasional laboratory or field trip. Brief history of phytopathology, study of epidemiological principles and their application in tree disease management. Survey of disease management strategies in various regions of the U.S. Spring (odd years).
Prerequisite: EFB 340.

EFB 643. Plant Virology ....(3)
Two hours of lecture and three hours of laboratory. History of plant virology, identification, and characterization of plant viruses, including transmission mechanisms, vector relationships, purification, and serology. Laboratory will present techniques for the identification and characterization of plant viruses. Spring (even years).
Prerequisite: EFB 303, equivalent, or consent of the instructor.

EFB 645. Plant Ecology ....(3)
Two hours of lecture and discussion and one laboratory/discussion. A first course in plant community ecology for beginning graduate students focusing on dynamics of community development and change and the processes of community analysis and
Prerequisite: EFB 320 or equivalent.

EFB 651. General Insect Taxonomy ....(3)
Two hours of lecture and three hours of laboratory. Identification and classification of the important orders and families of insects; acquaintance with pertinent taxonomic literature and use of keys; and understanding of evolutionary principles and concepts and a knowledge of systematic theory and practice. Insect collection required. (Alternative odd years.)
Prerequisite: EFB 565.

EFB 660. Insecticide Toxicology Laboratory ....(2)
One hour of discussion and three hours of laboratory. Laboratory experiments in mode of action and behavior of insecticides, biological and instrumental analysis of insecticides including tracer analyses. Spring (odd years).
Prerequisites: EFB 560 or equivalent and permission of the instructor.

EFB 678. Practicum in Terrestrial Community Ecology .....(3)
One hour of lecture, one hour TBS, and three hours of laboratory. Intensive practical application of ecological principles to the study of terrestrial animal communities. Includes experimental and field collection of data, quantifications, synthesis, and final reporting. Fall.
Pre- or Corequisite: EFB 578 or equivalent.

EFB 680. Behavioral and Physiological Ecology ....(3)
Two hours of lecture and one hour of discussion. An examination ofthe concepts of animal adaptations to ecological change from a behavioral point of view. Particular emphasis will be placed on the role the environment plays in shaping the behavior of a given species. Behavioral and physiological responses to environmental conditions will be treated as a continuum. Spring (odd years).
Prerequisites: One course in ecology, behavior, and physiology.

EFB 682. Invertebrate Symbiosis ....(3)
Two hours of lecture and one three-hour laboratory. An introduction to the ecology and evolution of interspecific relationships of invertebrates. Spring (even years).
Prerequisites: EFB 320, EFB 482.

EFB 689. Animal Physiological Ecology..........(3)
Three hours of lecture per week. A detailed and critical examination of principles and current dogmas in physiological ecology. Topics to be covered: The physical environment and physiological adaptation; the biology of body size; physiologically optimizing use of energy and materials. Spring (alternate even years).
Prerequisites: EFB 489 (or equivalent) or permission of the instructor.

EFB 691. Habitat Inventory and Evaluation ....(3)
Four hours of lecture and discussion. For students intent on careers in natural resource management, environmental planning or environmental impact analysis. Focus is on methods for investigation of species-habitat relationships, and construction of models for the inventory and evaluation of habitat. State-of-the-art habitat evaluation procedures are explored. Spring.
Pre- or Corequisite: Multivariate Statistics.

EFB 692. Ecology and Management of Waterfowl ....(3)
A detailed examination of waterfowl ecology and management. The course is structured around the annual cycle, focusing on strategies of survival and reproduction; management aspects are treated throughout the course. Fall.

EFB 693. Wildlife Habitats and Populations ....(4)
Three hours of lecture/discussion and one three-hour laboratory per week, one Saturdaty field trip required. Application of ecological concepts including succession and population biology to wildlife management planning and program assessment. Students are exposed to U.S. Fish and Wildlife Service habitat evaluation procedures and fundamentals of population modeling. Fall.
Prerequisite: EFB 490/491, or graduate student standing.

EFB 695. Urban Wildlife ....(2)
Three hours of lecture and discussion with field trips. A study of the occurrence, adaptations, and values of wildlife in urbanized areas, with emphasis on current research and agency programs. Spring (even years).

EFB 720. Topics in Soil Invertebrate Ecology ....(3)
Two one-hour lecture and discussion periods and a three-hour laboratory. Study of literature relating to soil invertebrate microcommunities; taxonomy, culturing, and collection methods of soil fauna; student will conduct an individual research problem. Spring (odd years).

EFB 724. Seminar in Aquatic Ecology.......................(1)
Two hours of lecture and discussion. A seminar to explore in some depth areas of current research in aquatic ecology. Fall (even years).
Prerequisite: Six credits in aquatic ecology.

EFB 733. Techniques in Plant Physiology ....(2-4)
Comprehensive study of techniques essential for research in plant physiology. Students may choose the instructors they wish to work with, and should consult the instructors for further details. May be repeated for credit in different specialties. Fall and Spring.
Prerequisites: EFB 531 or equivalent, biochemistry with laboratory.

EFB 740. Mycorrhizae ....(3)
Two hours of lecture and three hours of laboratory/discussion. A basic background course covering structural, functional, and ecological aspects of mycorrhizae; their methods of field and laboratory study; and applications in forestry practice. Fall (odd years).

EFB 741. Topics in Phytopathology ....(3)
Two two-hour lectures and discussions. Discussions of specific subject in phytopathology and wood microbiology. Topic selection is based on availability of expertise and will be announced in advance. This course may be repeated for credit in different specialties. Fall or Spring.

EFB 745. Topics in Plant Ecology................(2)
Two hours of seminar and discussion. An advanced course dealing with current research in plant community dynamics. May be repeated for additional credit. Fall.
Prerequisite: EFB 445 or EFB 645.

EFB 790. Topics in Wildlife Biology ....(1-3)
Hours to be arranged. Group study of a wildlife management topic. Fall or Spring.
Prerequisite: Six credits of wildlife management courses.

EFB 796. Topics in Environmental and Forest Biology ...(1-3)
Special instruction, conference, advanced study, and research in selected subject areas. Typewritten report required. Check Schedule of Courses for details. Fall and Spring.

EFB 797. Seminar in Environmental and Forest Biology ....(1)
Seminar discussions of subjects of interest and importance in environmental and forest biology. Seminar offerings are available in most subdisciplinary areas. Check Schedule of Courses for details. Fall and Spring.

EFB 798. Research Problems in Environmental and Forest Biology ....(Credit hours to be arranged)
Individual advanced study of selected special problems in environmental and forest biology. Offered by arrangement with individual faculty. Typewritten report required. Fall and Spring.

EFB 830. Physiology of Growth and Development ....(2)
Lecture. A study of the growth and development of plants and the physiological and biochemical processes that influence the development of form and structure in higher plants. Fall (even years).
Prerequisites: EFB 530, EFB 532, and organic chemistry.

EFB 840. Advanced Mycology, Homobasidiomycetes ....(3)
Review of selected literature as well as laboratory training in identification and research techniques. Fall.
Prerequisite: EFB 540.

EFB 841. Advanced Mycology, Heterobasidiomycetes ......(3)
Review of selected literature as well as laboratory training in identification and research techniques. Spring (even years).
Prerequisite: EFB 540.

EFB 842. Advanced Mycology, Ascomycetes ....(3)
Review of selected literature as well as laboratory training in identification and research techniques. Spring (odd years).
Prerequisite: EFB 540.

EFB 843. Advanced Mycology, Deuteromycetes ....(3)
Review of selected literature as well as laboratory training in identification and research techniques. Fall (even years).
Prerequisite: EFB 540.

EFB 851. Advanced Insect Taxonomy ....(3)
Two hours of lecture and three hours of laboratory. Methods, procedures, and concepts of systematics. Examples and material will be drawn from among important groups of forest insects. Fall.
Prerequisite: EFB 651.

EFB 898. Professional Experience ....(1-12)
Professional experience which applies, enriches, and/or complements formal coursework. Graded on an "S/U" basis. Fall, Spring, and Summer.

EFB 899. Master's Thesis or Project Research ....(1-12)
Investigation leading to the completion of a research-oriented thesis or to an application-oriented project. Graded on an "S/U" basis. Fall, Spring, and Summer.

EFB 980. Topics in Animal Behavior ....(2)
Two hours of lecture and discussion. A seminar-type course designed to explore in depth selected and controversial subject areas in animal behavior. Fall or Spring.

EFB 999. Doctoral Thesis Research ....(1-12)
Investigation leading to the completion of the doctoral thesis. Graded on an "S/U" basis. Fall, Spring, and Summer.

EIN—ENVIRONMENTAL INFLUENCES (LANDSCAPE ARCHITECTURE)

(See also courses listed under CMN and LSA.)

EIN 371. American Landscape History ....(3)
Three hours of lecture and discussion per week. The history of human-environmental interaction in America since colonial times. Reviews the prevalent ideas and attitudes during various periods, and the development of the environmental professions. Uses a humanistic and ecological approach to understand the landscape in relation to changes in population, technology, economics, social organizations, and attitudes. Fall or Spring.
Prerequisite: Landscape Architecture major or permission of the instructor. A student may not receive credit for both EIN 371 and EST 371.

EIN 390. Social/Cultural Influences and Environmental Form ....(3)
Three hours of lecture. This course provides an introduction to an interdisciplinary social science analysis of human settlements. The course introduces the basic concepts, vocabulary, theories, and units of analysis for an interdisciplinary social perspective of the environmental form of human settlements. As such, it focuses upon developing an understanding of the context for the planning and design of human settlements. Course requirements include readings, examinations, and reports. Field trips may be scheduled. Spring.

EIN 471. History of Landscape Architecture ....(3)
Three hours of lecture. Informal lectures and class participation, reports, assigned text and assigned reserve shelf reading, optional text and handout notes, quizzes and exams. Slides. Historical study and style analysis of Western man's efforts to design his environment and his changing attitudes and relationships to environment. Also, non-Western coverage where significant or influential on Western Man. Study of historical personalities as well as periods that are of environmental concern up into the modern period. Fall.
Prerequisite: Permission of the instructor.

EIN 496. Special Topics in Environmental Studies ....(1-3)
Special topics of current interest to undergraduate students in Environmental Studies and related fields. A detailed course subject description will be presented as the topic area is identified and developed. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor.

EIN 510. Creative Problem Solving Seminar ....(3)
Three hours of lecture and discussion. A course designed to extend the student's understanding and application of creative problem solving processes. One requirement will be to select and carry out an application of the techniques to a particular problem, with consultation andguidance from the instructor. Critique and survey of the literature on creativity; in-depth analysis of the synectics process, and various procedures which have been developed for nurturing creative behavior comprise the essence of the program. Spring.

EIN 560. Negotiating Environmental Disputes ....(3)
Two hours of lecture and two hours of recitation/workshop per week. An introductory course to help students acquire and refine skills in listening, problem solving, assertion, and conflict management. These interpersonal skills are useful in many situations; however, the emphasis will be upon using them to resolve environmental conflicts. Approaches to learning will include theory presentation, skill demonstration, skill practice and critique. Fall or Spring.

ENS—ENVIRONMENTAL SCIENCE

ENS 601. Water Resources Management ....(3)
Three hours of lecture and discussion. This course provides an introduction to interdisciplinary water management. It draws upon subject matters from many areas, including water

policy, planning, economics, hydrology, law, engineering, and water quality. Fall.

ENS 611. Environmental Institutions ....(3)
Three hours of lecture and discussion per week. Examination of the interrelationships of policymaking and environmental program implementation in government, the role of the legal process in environmental management, and techniques for program evaluation. Fall.

ENS 612. Environmental Information Systems ....(3)
Two credit hours of lecture/discussion and three credit hours of laboratory per week. Description and quantification of land resources and human activities as a basis for subsequent environmental modeling and policy analysis. Fall.
Prerequisite: Statistics is pre- or co-requisite.

ENS 621. Environmental Policy Analysis ....(3)
Three hours of lecture and discussion per week. Theoretical approaches to environmental policy studies and applied economic, political science and legal approaches to policy analysis, quantitative assessment, modeling, benefit/cost analysis, risk assessment, and decision analysis.
Pre- or co-requisite: Economics and statistics. Spring.

ENS 622. Environmental Systems ....(3)
Two hours of lecture and discussion per week and three hours of computer lab per week. Introduction to systems theory and development of modeling concepts; modeling and computer simulation of complex social and physical systems in applied environmental contexts. Spring.
Pre- or co-requisite: Statistics and ecology.

ENS 631. Uncertainty and Environmental Assessment .....(3)
Three hours of lecture/discussion. An analysis of methods for recognizing, quantifying, and assessing uncertainty in policy-driven environmental assessment. Topics include conceptualization and definition of risk and uncertainty, use of probability theory for treatment of uncertainty in environmental assessment, communication of information about uncertain empirical quantities, human judgement in the presence of uncertainty, propagation of uncertainty through mathematical models, and assessment of the implications of uncertainty in quantitative models. Spring.
Prerequisite: Satisfactory completion of APM 395 or an equivalent calculus-based introduction to probability and statistics.

ENS 687. Environmental Law and Policy ....(3)
Three hours of lecture and discussion per week. Study of the legal system and selected federal statutes dealing with environmental protection including the National Environmental Policy Act, Clean Air Act, Clean Water Act and Waste Management Laws.

ENS 696. Special Topics in Environmental Science and Policy ....(1-3)
Experimental and developmental courses in new areas of interest to environmental studies faculty and graduate students not covered in regularly scheduled courses.

ENS 796. Advanced Topics in Environmental Science and Policy ....(1-3)
Lectures and discussions, seminars, conferences, and group research on advanced topics of special or current interest, in fields of interest to environmental studies faculty and graduate students. Fall and Spring.

ENS 797. Environmental Science Seminar ....(1-3)
Discussion of current topics and research related to environmental science. Fall and Spring. Staff.

ENS 798. Problems in Environmental Science and Policy.....(Credit hours to be arranged)
Individualized, special study of environmental science and policy subjects and issues. Comprehensive oral or written report required for some problems. Fall, Spring, and Summer.

ENS 898. Professional Experience ....(1-12)
Professional experience which applies, enriches, and/or complements formal coursework. Graded on an "S/U" basis. Fall, Spring, and Summer.

ENS 899. Master's Thesis Research ....(Credit hours to be arranged)
Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

ENS 999. Doctoral Thesis Research ....(Credit hours to be arranged)
Research and independent study for the doctoral degree and dissertation. Fall, Spring, and Summer.

When choosing courses, students must consult their advisors/major professors.

ERE—ENGINEERING (ENVIRONMENTAL AND RESOURCE ENGINEERING)

ERE 222. Engineering Mechanics—Dynamics ....(2)
Two hours of lecture. Kinematics and kenetics of particles and rigid bodies; rectangular, normal and tangential, radial and transverse components; translation and rotation; force and acceleration; impulse; momentum; work and energy; impact.
Prerequisites: Statics and Calculus II.

ERE 306. Elements of Map and Air Photo Interpretation ....(1)
Two hours of lecture and three hours of laboratory per week for five weeks of a semester. Introduction to map and photograph interpretation to extract information useful to site and resource inventory, analysis, planning, and design activities. The basic physical and geometric properties of maps and photographs, the characteristics of information contained in them, and elementary principles and procedures of interpretation are discussed. Spring.
Prerequisite: College level algebra and plane trigonometry.

ERE 308. Elements of Plane Surveying ....(1)
Two hours of lecture and three hours of laboratory per week for the last five weeks of the semester. Introduction to the principles and procedures of plane surveying for mapping and construction layout purposes. Topics briefly discussed include the basic mathematical principles of surveying, the types and uses of surveying, horizontal and vertical distance measurement, angle measurement, traversing and computations, construction layout, tacheometry, and surveying errors (and their treatment). Spring.
Prerequisite: College level algebra and plane trigonometry.

ERE 320. APL for Engineers and Scientists ....(2 or 3)
Programming and operation of time-sharing digital computer systems via the APL language. Analysis, modeling, and solution of basic problems in environmental science and engineering. Students desiring three credits will complete an original, substantial term project. Spring.
Prerequisites: Calculus and physics or permission of the instructor.

ERE 350. Wood Preservation ....(2)
Two hours of lecture with some demonstrations. A survey of basic woodwater relationships, shrinking and swelling, elementary wood structure, wood seasoning and drying, wood permeability, capillary forces, heat transmission, agencies of wood deterioration, wood preservation processes, wood fire performance, fire tests, and fire retardant treatments. Not open to WPE students. Fall.

ERE 351. Basic Engineering Thermodynamics ..(2)
Principles of energy conservation and conversion: first and second laws. Relation to PVT behavior, property functions, equilibria, and heat and mass transfer. Introduction to engineering problem analysis and computer methods. Spring.

Prerequisites: Physics, general chemistry, and calculus. Not open for credit to students who have completed successfully FCH 360 or equivalent.

ERE 352. Applied Engineering Thermodynamics .... (2)
Classical principles applied to devices and systems. Emphasis on efficient design of manufacturing equipment and processes. Power and refrigeration cycles; energy conservation; materials recovery. Environmental case studies and design project. Computer-aided data correlation and system simulation. Spring.
Prerequisites: ERE 351, FCH 360, or equivalent.

ERE 362. Mechanics of Materials .... (3)
Three hours of lecture. Theories of stress, deformation, and stability of common structural materials subjected to various force systems. Fall.
Prerequisites: Integral calculus and statics.

ERE 364. Engineering Materials .... (3)
Two hours of lecture and one three-hour laboratory per week. An introduction to the scientific study of materials used in industry. Metals, ceramics, and polymers are covered. Lab work includes fabrication, testing, and evaluation of actual systems. Spring.
Prerequisites: Junior standing, physics, chemistry, and engineering mechanics.

ERE 371. Surveying for Engineers .... (3)
Two hours of lecture and recitation and three hours of laboratory. The principles of plane surveying for engineers. Subject matter areas include introduction to the theory of measurement and errors, reference surfaces, linear and angular measurements in both the horizontal and vertical planes, traversing and computations, horizontal and vertical control and associated computations, areal and volumetric computation, construction surveying including circular and parabolic curves, coordinate systems, property and public land surveys, the analysis and treatment of systematic and random errors. Laboratory field work and computations culminate in a topographic map. Elementary computer processing is introduced. Fall.
Prerequisites: Calculus.

ERE 375. Elementary Corrosion .... (1)
One hour of lecture. Basic electro-chemistry, film formation and passivation, galvanic corrosion and pitting, cathodic and anodic protection, protective coatings and inhibitors. Application of the above in the home, car, field, at sea, and in industrial plants. Spring.

ERE 420. Computer Applications in Science and Engineering .. .. (3)
Principles and methods of mathematical modeling for analog and digital computer solution. Applications to data reduction and correlation, statistical analysis, process and equipment simulation, optimization and control, and computer-assisted instruction. Typical examples, class problems and student projects. Current status and future projection of computational equipment, software and operating techniques. Fall.
Prerequisites: Calculus and computer programming, or permission of the instructor.

ERE 422. Process Design and Simulation .... (3)
Two hours of lecture/discussion and three hours of design laboratory per week. Mathematical modeling of process units and systems. Consideration of energy requirements, operating costs, and optimization techniques. Steady-state and dynamic simulation via computer programs. Use of data sources and software, applied to design exercises and case studies. Spring.
Prerequisites: Unit operations and computer programming, or permission of the instructor.

ERE 440. Water Pollution Engineering .... (3)
Two hours of lecture and three hours of laboratory. Introduction to the physical, chemical, and biological parameters of waste water treatment processes and to the principles of the unit operations involved. Study of the design parameters and design procedures of waste water treatment systems. Spring.
Prerequisites: Physics and CHE 356 or equivalent.

ERE 441. Air Pollution Engineering .... (3)
Three hours of lecture and discussions. Study of the chemical, physical and meteorological principles of air pollution and its control. Local and global effects of air pollution. The atmospheric survey. Examination of the operating principles and design parameters of the various air pollution control systems. Air quality and emission standards. Fall.
Prerequisites: Physics and CHE 356 or equivalent.

ERE 496. Special Topics .... (1-3)
Lectures, readings, problems, and discussions. Topics as announced in the areas of environmental or resource engineering. Fall and/or Spring.

ERE 500. Engineering Fundamentals .... (3)
This course provides a foundation and frame-of-reference for nonengineers entering graduate study. Completion enables nonengineering students to solve simple, applied problems in engineering science fundamentals. The course also helps the student recognize good and poor approaches to problem formulation and analysis, and to be better preparedto deal with technical, social, and economic constraints on environmental problem solving. Enrollment limited. Fall.
Prerequisite: Permission of the instructor.

ERE 505. Waste Management .... 3)
A multidisciplinary course. Course begins with foundation materials and progresses through a series of field trips and guest lectures aimed at preparing students to develop and communicate details of feasible alternative designs for waste management facilities/programs for specific case studies. Enrollment limited. Fall.
Prerequisite: Permission of the instructor.

ERE 510. Energy: Alternate Systems .... (3)
Three hours of lecture. An introduction to alternate energy resources and conversion processes. Focus is on relatively small-capacity, decentralized systems and means for judging appropriateness, costs, and impacts of application under varying conditions and needs. Instruction modules on passive and active solar heating, wind energy system, biomass resources and conversion, including ethanol production, methane recovery and wood gasification, and internal combustion cogeneration.

ERE 552. Fundamentals of Remote Sensing .... (3)
Two hours of lecture and three hours of laboratory per week. Principles and techniques of environmental remote sensing including potentials, limitations, instrumentation, and unique requirements. Procedures and principles of acquiring, analyzing, and using a wide range of imagery types for environmental applications and design. Both qualitative and quantitative interpretation procedures are presented. Oriented for multidisciplinary participation. Fall or Spring.
Prerequisite: College physics and calculus or consent of the instructor.

ERE 563. Photogrammetry I .... (3)
Two hours of lecture and discussion, three hours of laboratory and discussion. Basic photogrammetric and photo interpretation concepts as a means of acquiring reliable data for engineering and management planning. Potentials, limitations, instrumentation and unique requirements are considered. Fall and Spring.
Prerequisite: ERE 371 or equivalent.

ERE 585. Microscopy and Photomicrography .... (3)
Two hours of lecture, one hour of demonstration, and three to five hours of laboratory. Principles of light microscopy and photomicrography with extensive laboratory practice. Introduction to scanning and transmission electron microscopy. Fall.
Prerequisite: Permission of the instructor.

ERE 596. Special Topics .... (1-3)
Lectures, conferences, discussions, and laboratory. Topics in environmental and resource engineering not covered in established courses. Designed for the beginning graduate student or selected upper division undergraduate. Fall and/or Spring.

ERE 642. Water Quality Modeling .... (3)
Two hours of lecture and three hours of laboratory per week. An analysis of the biological, chemical, and physical factors of receiving waters governing the action of wastes and their reactions in receiving waters. Introduction to modeling techniques applicable to water quality management issues. Fall.
Prerequisite: ERE 440 or equivalent as evaluated by the instructor.

ERE 643. Water Pollution Engineering .... (3)
Two hours of lecture and three hours of laboratory. Introduction to the physical, chemical, and biological parameters of waste water treatment processes and to the principles of the unit operations involved. Study of the design parameters and design procedures of waste water treatment systems. Spring.
Prerequisites: Physics and CHE 356 or permission of the instructor.
Note: A student may not enroll in or receive credit for both ERE 440 and ERE 643.

ERE 655. Infrared Remote Sensing Measurements .... (3)
Two hours of lecture comprising an in-depth coverage of the reflective and emissive properties of terrestrial materials in the near-, middle- and thermal-infrared regions of the electromagnetic spectrum. The relationship between factors related to natural resources and the upwelling radiance field will be discussed. Techniques for recording images of the earth in the near- to thermal-infrared region will be considered. This will include a discussion of sensing systems, the atmosphere and relevant optical principles. Focal plane array sensors will be discussed. Every third Fall.
Prerequisites: FEG 350 or FEG 352 or equivalent, at least three semesters of calculus, two semesters of physics.

ERE 656. Optical Remote Sensing Measurements .... (3)
Two hours of lecture comprising an in-depth coverage of the optical properties of terrestrial properties. The relationship between the radiance reflected from the earth's surface and factors related to natural resources will be considered. Techniques for recording images of the earth in reflected radiation in the 0.41.1m region will be discussed. This will include an extensive review of the design principles of imaging sensors. Both digital and analog remote sensing devices will be covered. Optical and electronic design criteria will be covered, together with a discussion of data characteristics. Every third Fall.
Prerequisites: FEG 350 or FEG 352 or equivalent, at least three semesters of calculus, two semesters of physics.

ERE 657. Microwave Remote Sensing Measurements ...... (3)
Three hours of lecture comprising a survey of the microwave emissivity and scattering cross section characteristics of a range of features. Techniques for imaging the earth in the microwave region of the electromagnetic spectrum will be discussed. This will include consideration of various ground-based and airborne radars and passive microwave scatterometers. Search and phased array radars will also be considered. Data analysis will be dealt with. Every third Fall.
Prerequisites: FEG 350 or 352 or equivalent, at least three semesters of calculus, two semesters of physics.

ERE 664. Photogrammetry II .... (3)
Two hours of lecture and three hours of laboratory. General analytic photogrammetry including interior and exterior orientation systems, intersection space resection and orientation. Correction of photo coordinates for film deformation, lens distortions, atmospheric refraction and earth curvature. Introduction to photogrammetric plotters. Planning photogrammetric projects, and designing optimum procedures for selected photogrammetric tasks. Fall.
Prerequisite: ERE 563 or equivalent.

ERE 670. Principles of Pulping and Bleaching .... (3)
Two hours of lecture and three hours of laboratory plus literature study of assigned topics, independent project planning and/or laboratory study. Discussion of pulping and bleaching processes. Effects of chemical and physical variables on the wood components and pulp properties; chemistry involved. Experiments in pulping and bleaching and pulp evaluation. Fall.
Prerequisites: Organic, physical, and analytic chemistry.
Note: A student may not enroll in or receive credit for both PSE 461 and ERE 670.

ERE 671. Chemistry of Pulping and Bleaching .... (3)
Three hours of lecture. Discussion of the chemistry underlying the commercial pulping and bleaching processes, designed to assist in interpreting the phenomena observed in these operations. Emphasis is placed on those reactions which contribute to delignification and the removal of chromophormic groups in lignin and extractives. Spring.
Prerequisite: FCH 572 or permission of the instructor.

ERE 675. Principles of Unit Operations .... (4)
Three hours of lecture and discussion and one two-hour computation period. Fundamentals of fluid dynamics, heat and mass transfer, appropriate analogies and process applications. Stage operations and computation methods. Application to distillation, extraction, gas absorption, evaporation, crystallization and drying. Design, operation, and computer simulation of equipment. Fall.
Prerequisites: Calculus and physical chemistry or permission of the instructor.

ERE 677. Paper Properties .... (4)
Three hours of lecture, three hours of laboratory, and discussion plus evaluation of literature, independent project planning and/or laboratory study. Evaluation and study of the physical, optical, and chemical properties of paper and the interrelationships existing between paper manufacturing methods, papermaking additives, test results and the ultimateproperties desired in the finished paper. Fall.
Prerequisite: Permission of the instructor.
Note: A student may not enroll in or receive credit for both PSE 465 and ERE 677.

ERE 678. Paper Coating and Converting .... (2)
Two hours of lecture plus evaluation of literature, independent project planning, and/or laboratory study. Evaluation and study of the various coating materials and processes used by the paper industry. Introduction to polymers and their use in converting operations, fundamentals and parameters which control their use, effects on final properties of papers. Spring.
Prerequisite: PSE 465 or permission of the instructor.
Note: A student may not enroll in or receive credit for both PSE 466 and ERE 678.

ERE 682. Transport Processes .... (3)
Two hours of lecture and three hours of laboratory. The relationship between wood structure and wood permeability, moisture movement, and heat transfer. Fire retardant and wood preservation treatments. Wood drying. Unsteady-state transport processes. An advanced laboratory problem with report in wood-moisture relationships, wood drying, the relationship between wood permeability and treatability, or wood preservative treatments. Spring.
Prerequisite: Permission of the instructor.
Note: A student may enroll in or receive credit for WPE 326 and WPE 327 or ERE 682.

ERE 684. Mechanical Properties of Wood .... (3)
Two hours of lecture and three hours of laboratory. The effect of the anatomical and chemical nature of wood on its response to static and dynamic force systems. The theory of elasticity as applied to wood and wood-based composites. Spring.
Prerequisite: Permission of the instructor.

ERE 685. Transmission Electron Microscopy ..(5)
Two hours of lecture, two hours of laboratory/demonstration, minimum of ten hours of individual laboratory. The theory and operation of the transmission electron microscope including specimen preparation, photographic technique and interpretation of micrographs. Fall.
Prerequisite: Consultation with the instructor.

ERE 686. WoodWater Relationships ....(3)
Two hours of lecture and three hours of laboratory. Relationship between wood moisture content and the environment, electrical and thermal properties, theories of moisture sorption, hygroscopic swelling and shrinking, thermodynamics of moisture sorption, mechanism of moisture movement as it relates to activation theory. Laboratory exercises will complement the theoretical topics discussed in the lecture. Fall.
Prerequisite: Permission of the instructor.

ERE 688. Tropical Timbers in Commerce ....(2)
Two hours of lecture. Introduction to the commercial use of tropical timbers; the factors of forest conditions, stand types and wood qualities influencing their utilization and the development of trade. Sources of information. Spring.
Prerequisite: Permission of the instructor.

ERE 689. Tropical Wood Anatomy..........................(1)
Anatomical characters, identification and taxonomy of tropical woods important in commerce. Spring.
Prerequisite: WPE 386 or WPE 387. Recommended that ERE 688 be taken concurrently or previously.

ERE 691. Air Pollution Engineering ....(3)
Three hours of lecture and discussion. Study of the chemical, physical, and meteorological principles of air pollution and its control. Local and global effects of air pollution. The atmospheric survey. Examination of the operating principles and design parameters of the various air pollution control systems. Air quality and emission standards. Fall.
Prerequisites: Physics and CHE 356 or permission of the instructor.
Note: A student may enroll in or receive credit for both ERE 441 and ERE 691.

ERE 760. Analytical Photogrammetry I.....................(3)
Two hours of lecture and three hours of laboratory. Mathematical theory of photogrammetry including space resection, orientation, intersection and aerial triangulation. Spring.
Prerequisites: FEG 363, APM 360 and FEG 464 or equivalent.

ERE 775. Applied Thermodynamics ....(3)
The study and application of thermodynamics, including the first and second law, phase relationships, thermochemistry, the production of work and equilibrium relationships. Spring.
Prerequisites: FCH 360, FCH 361 or equivalent.

ERE 785. Scanning Electron Microscopy ....(5)
Two hours of lecture, demonstration and laboratory. Six hours of independent laboratory experience. The theory and operation of the scanning electron microscope including specimen preparation, photographic technique, and interpretation of micrographs. Spring.
Prerequisite: Permission of the instructor.

ERE 790. Advanced Image Analysis ....(3)
Two hours of lecture, plus laboratory. In this course, the acquisition of both analog and digital imagery will be considered. The relationship between the scene and the image will be considered as a precursor to digital image operations which may be performed to solve specific problems. Operations performed upon image planes to provide a two-dimensional image of use to the interpreter will be discussed. Various digital image analysis techniques will be covered. Fall or Spring.
Prerequisites: FEG 350 or 352 or equivalent, at least three semesters of calculus.

ERE 796. Advanced Topics ....(1-3)
Lectures, conferences, discussions, and laboratory. Advanced topics in Forest Engineering, Paper Science and Engineering, and Wood Products Engineering. Fall and/or Spring.
Prerequisite: Permission of the instructor.

ERE 797. Seminar ....(1-3)
I. Forest Engineering topics. II. Paper Science and Engineering topics. III. Wood Products Engineering topics. Fall and Spring.

ERE 798. Research in Environmental and Resource Engineering ....(Credit hours to be arranged)
I. Independent research topics in Forest Engineering. II. Independent research topics in Paper Science and Engineering. III. Independent research topics in Wood Products Engineering. Fall, Spring, and Summer.

ERE 899. Master's Thesis Research ....(Credit hours to be arranged)
Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

ERE 999. Doctoral Thesis Research ....(Credit hours to be arranged)
Research and independent study for the doctoral degree and dissertation. Fall, Spring, and Summer.

ESF—NONDEPARTMENTAL

ESF 332. Seminar for New Transfer Students......(No Credit)
One hour of weekly lectures and discussions designed to introduce the transfer student to the College and its academic and social environs. Fall and Spring.

EST—ENVIRONMENTAL STUDIES

EST 300. Introduction to Environmental Studies ....(3)
Two hours of lecture and discussion and three hours of workshop per week. An introduction to the interrelationships among the natural environment, people, and the human environment. An experiential learning approach is used to develop critical facilities and systems thinking useful for assessing environmental issues. Fall.

EST 311. Natural Processes in Planning and Design ....(3)
Three hours of lecture and discussion per week. An overview presentation of the basic principles governing the dynamics of natural resources and processes and their implication for the planning, design, and management of natural and human environments. Sources and use of environmental data are discussed and illustrated. Occasional field trips may be required. A student may not receive credit for both EIN 311 and EST 311. Fall.

EST 321. Government and the Environment ....(3)
Three hours of lecture and discussion. An investigation of institutional influences on the American environment. Federal government and its role in environmental management and protection is emphasized. The pressures contributing to the formation of environmental policy are introduced. The practical consequences of this system are demonstrated through case studies. Fall.

EST 371. American Landscape History ....(3)
Three hours of lecture and discussion. The history of human-environment interaction in America since colonial times. Reviews the prevalent ideas and attitudes during various periods, and the development of the environmental professions. Uses a humanistic and ecological approach to understand the landscape in relation to changes in population, technology, economics, social organization, and attitudes. A student may not receive credit for both EIN 371 and EST 371. Spring.

EST 390. Social Processes and the Environment.. ....(3)
Three hours of lecture and discussion. A multidisciplinary social science perspective on the nature of the physical environment, particularly as it relates to the creation of human habitat. Human-environment interactions are viewed at three scales: (1) macro-interactions concerning social and economic issues; (2) meso-interactions concerning behavior of groups; (3) micro-interactions concerning perceptions and attitudes of individuals. Disciplines from which material may be drawn include: anthropology, ethology, geography, political science, psychology, and sociology. Spring.

EST 400 Senior Paper ....(3)
Individual study of an environmental topic resulting in a formal report that meets the requirements for an Environmental Studies synthesis experience. These requirements are identified in course meetings. Enrollment is restricted to Environmental Studies seniors. Fall and Spring.

EST 495. Selected Readings in Environmental Studies ... (1-3)
An in-depth and independent exploration of selected readings from the environmentally related literature. Emphasis is placed on gaining insights and understanding from the readings, rather than producing an extensive bibliography. Fall, Spring and Summer.
Prerequisite: Approval of study plan by the instructor.

EST 496. Special Topics in Environmental Studies ....(1-3)
Special topics of current interest to undergraduate students in Environmental Studies and related fields. A detailed course subject description will be presented as the topic area is identified and developed. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor.

EST 498. Introductory Research Problems ....(1-3)
Guided individual study of an environmental topic. Emphasis is on the study procedure and the methods employed. Enrollment is possible at various times during the semester. Fall, Spring, and Summer.
Prerequisite: Approval of study plan by the instructor.

EST 499. Environmental Studies Internship ....(1-12)
Internships provide students with a supervised field experience to apply and extend their academic abilities in a professional working environment. Enrollment is possible at various times during the semester. Fall, Spring, and Summer.
Prerequisite: Environmental Studies senior standing and written approval of an internship contract by major professor, curriculum director, and field supervisor.

FCH—FOREST CHEMISTRY

FCH 221. Organic Chemistry I ....(3)
Three hours of lecture. The structure, properties, and fundamental reactivity of organic compounds will be studied with emphasis on the reaction mechanisms and stereochemistry. In combination with FCH 223, this course provides a full survey of common classes of carbon compounds. Fall.
Prerequisites: One year of general chemistry.

FCH 222. Organic Chemistry Laboratory I ....(2)
One hour of pre-laboratory instruction. Three hours of laboratory.
Laboratory safety. Melting and boiling points, distillation, recrystallization, thin-layer and column chromatography, and isolation of natural products. Qualitative functional group analysis. Fall.

FCH 223. Organic Chemistry II ....(3)
Three hours of lecture. The structure, properties, and fundamental reactivity of organic compounds will be studied with emphasis on the reaction mechanisms and stereochemistry. In combination with FCH 221, this course provides a full survey of common classes of carbon compounds. Spring.
Prerequisite: FCH 221 Organic Chemistry I or equivalent.

FCH 224. Organic Chemistry Laboratory II.....(2)
Four hours of laboratory including pre-laboratory instruction. Continuation of FCH 222. Simple physical and instrumental techniques applied to organic chemistry. Gas chromatography, polarimetry, kinetics. Introduction to classical literature syntheses. Spring.
Prerequisite: FCH 222 or equivalent.
Corequisite: FCH 223 or equivalent.

FCH 325. Organic Chemistry III ....(4)
Two hours of lecture, one six-hour laboratory. Classical and recent literature synthesis or organic compounds, employing advanced tech niques. Fall.
Prerequisite: Two semesters of elementary organic chemistry.

FCH 360. Physical Chemistry I ....(3)
Three hours of lecture. Includes discussion on the properties of gases and liquids, laws of thermodynamics, solutions and colligative properties, and electrochemical cells. Fall.
Prerequisites: One year of college physics, differential and integral calculus.

FCH 361. Physical Chemistry II ....(3)
Three hours of lecture. Includes discussion on electrochemistry, principles of quantum mechanics, statistical mechanics, chemical kinetics, and basic spectroscopy. Spring.
Prerequisite: FCH 360 Physical Chemistry or the equivalent.

FCH 380. Analytical Chemistry I: Gravimetric, Titrimetric and Potentiometric Analysis ....(3)
Two hours of lecture and one three-hour laboratory. Equilibrium concepts and practical implementations of precipitation, complexation, acid-base, and oxidation-reduction processes in quantitative chemical analysis. Fall.
Prerequisites: Two years of undergraduate chemistry and FCH 360 (or equivalent) taken concurrently or permission of the instructor.

FCH 381. Analytical Chemistry II: Spectroscopic, Chromatographic and Electroanalytical Instrumental Techniques ....(3)
Two hours of lecture and one three-hour laboratory. Theory and practice of technology applications to UV/VIS, AAS, AES, XES, ASV, GLC, and HPLC. Spring.
Prerequisites: Two years of undergraduate chemistry and FCH 380, FCH 361 (or equivalent) taken concurrently or permission of the instructor.

FCH 384. Spectrometric Identification of Organic Compounds ....(1-2)
Two hours of lecture and discussion. The first half semester (1 credit) will deal with common classes of organic compounds; the second half semester (1 credit) will deal with more complex structures. The use of complementary information from mass, infrared, nuclear magnetic resonance, and ultraviolet spectrometry will be applied to identification of organic natural products. Spring.
Prerequisites: Organic chemistry; one semester of advanced organic chemistry for second credit.

FCH 390. Drugs from the Wild ....(3)
Three hours of lecture and discussion each week. This course is designed to give students a comprehensive understanding of the variety of medicinal agents available from natural sources. Economic and societal aspects will be explored as well as scientific ones. In addition to curative agents, discussions will include toxic substances, folk medicinal (including herbal) preparations, and the so-called "recreational drugs."
Prerequisites: Introductory courses in chemistry and biology.

FCH 440. Introduction to Chemical Ecology ....(3)
Three hours of lecture with discussion. Centers on chemical signals among organisms from microbes to man as they affect ecology, physiology, and behavior and as they can be utilized for agriculture, pest management, and animal hus-

bandry.

Prerequisites: Biology (one year), and organic chemistry (one year).

Note: Also listed as EFB 412.

FCH 495. Introduction to Professional Chemistry .... (1)
The professional chemist and his relationship with industry, government, and universities. Employment opportunities for the chemist, professional organizations, and unions will be discussed. The selection of a senior research topic and a literature survey will be required. Fall.

Prerequisite: Senior status.

FCH 496. Special Problems in Chemistry .... (1-3)
An opportunity for a special problem, technique development, independent or unstructured study in an area related to the chemical profession. The work may be technical, professional, or interdisciplinary. Advisors outside this department may be solicited. A brief proposal must be presented for approval with specific arrangements outlined including faculty advsior and objectives of the study. Evidence of competence an appropriate effort is required for credit. A written report will be expected Fall and Spring.

Prerequisite: Upper division status.

FCH 497. Undergraduate Seminar .... (1)
One hour per week. Literature surveys and seminars on topics of current research interest and recent advances in chemistry. Spring.

FCH 498. Introduction to Research .... (5)
Eighteen hours of laboratory, library search and report writing. Solution of a selected research problem using special laboratory techniques. Typewritten report on data, procedures, results, and conclusions. Spring.

FCH 510. Environmental Chemistry I .... (3)
Three hours of lecture. Introduction to the processes that control chemical behavior in aquatic environments, including precipitation, gas exchange, acid-base, redox, complexation, and adsorption reactions. Emphasis will be on explanation and prediction of chemical behavior, using computer models where appropriate. Examples will be from the areas of water and wastewater treatment, pollutant fates and geochemistry. Fall.

Prerequisites: An introductory course in physical chemistry is required and a shortcourse in computer programming is recommended.

FCH 511. Environmental Chemistry II .... (3)
Three hours of lecture. Includes a detailed chemical explanation of current topics of concern in environmental chemistry and the chemistry of pollution. Lectures will cover topics relating to air, soil and biota pollutional impact. Spring.

Prerequisite: Chemistry through physical chemistry, or consent of the instructor.

FCH 515. Methods of Environmental Chemical Analysis .... (3)
One hour of lecture and six hours of laboratory. An introduction to sampling, analytical and quality control procedures necessary to obtain reliable water quality data. All analyses will be performed on a single aquatic system with the purpose of developing a final report characterizing the water quality of that system. Fall.

Prerequisite: A course in quantitative chemical analysis.

FCH 519. Environmental Chemistry Seminar .... (1)
One hour of lecture. Seminars on current research and issues in environmental chemistry and related areas. Spring.

FCH 520. Nuclear and Radiation Chemistry .... (2)
The two one-hour lectures will cover the information required for the basic understanding of nuclear reactions, the types of radiation emitted, the instrumentation necessary to detect and measure this radiation, the principles of radioisotope tracer techniques, and radiation chemistry which is the effect of radiation on organic systems. Visits to the Cornell Reactor and the Nuclear Medicine Department of the SUNY Health Science Center at Syracuse will be arranged. Spring.

Prerequisites: Physical, organic and inorganic chemistry or by permission of the instructor.

Note: This course can be taken independently of FCH 521.

FCH 521. Nuclear Chemical Techniques .... (1)
The laboratory will consist of one four-hour laboratory class every two weeks, with one hour to be made up at the student's discretion to accommodate counting periods which extend over several weeks. A short movie by the AEC each week will be required for the sixth hour. The laboratory will give each student the opportunity to use the individual counting instruments, gain experience in the handling and preparation of radioactive samples and the use of the 1000-curie-cobalt source in radiation chemistry. Spring.

Prerequisite: Physical, organic, and inorganic chemistry or permission of the instructor. Advanced tentative registration is required.

Corequisite: FCH 520.

FCH 524. Topics in Natural Product Chemistry .... (3)
Three hours of lecture and discussion each week. A course intended to introduce the student to various types of secondary metabolites including several of past and current interest because of their pronounced biological activities. Modes of chemical reactivity and means of structure determination and syntheses are covered. Spring.

FCH 530. Biochemistry I .... (3)
Three hours of lecture. General biochemistry with emphasis on cellular constituents and metabolic reactions. The chemical, physical, and biological properties of amino acids, proteins, carbohydrates and their intermediary metabolism will be discussed. The chemistry of enzymes, energy transfers, and biological oxidations will also be covered. Fall.

Prerequisite: One year of organic chemistry.

Recommended: Physical chemistry.

FCH 531. Biochemistry Laboratory .... (2)
Six hours of laboratory. This course will stress techniques used in biochemical research. Techniques used include various types of chromatography, electrophoresis, spectrophotometry, and methods involved in the isolation, purification and assay of enzymes and nucleic acids. Fall.

Prerequisite: One semester of quantitative analysis with laboratory.

FCH 532 Biochemistry II .... (3)
Three hours of lecture. Topics discussed are: biosynthesis and degradation of amino acids and nucleic acids, protein biosynthesis, and an introduction to molecular biology. Spring.

Prerequisites: FCH 530 and its pre- and co-requisites.

FCH 550. Introduction to Polymer Science I: Polymer Synthesis and Mechanisms .... (3)
Three hours of lecture. Introduction to the synthesis of polymers and the mechanism of polymerization processes. Addition homopolymerization and copolymerization by radical, ionic and coordination type catalysts. Synthesis of block and graft copolymers. Stepwide polymerization, network formation and gelation. Structure of polymers and stereoregular polymerization. Degradation of polymers, reaction on polymers, polyelectrolytes. Fall.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

FCH 551. Polymer Techniques .... (2)
One hour of lecture/discussion and three hours of laboratory; lab reports, final exam. Ten experiments covering the main topics of polymer synthesis (2), molecular weight determination (4), and characterization (4) are selected from free-radical solution and emulsion polymerizations, copolymerization, condensation polymerization, osmometry, viscometry, light scattering, gel permeation chromatography, polarized light microscopy, X-ray diffraction, differential

scanning calorimetry, thermogravimetric analysis, stress-strain analysis, nuclear magnetic resonance. Fall.

Prerequisites: One year of organic and one year of physical chemistry.

FCH 552. Introduction to Polymer Science II: Polymer Properties and Technology .... (3)

Three hours of lecture. Introduction to the physical chemistry,, physics, processing and technology of synthetic polymers. Polymer solutions, including molecular weight determinations and chain statistics. Polymer solid states, including rubber elasticity,, viscoelasticity, the glassy state and the crystalline state. Properties, processing and technology of films, fibers, elastomers and foams. Spring.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

FCH 560. Chromatography and Related Separation Sciences .... (3)

Three hours of lecture and discussion each week. A course designed to give the student a thorough understanding of analytical and isolation chemistry by modern chromatographic, distributive and molecular sieving techniques. The chemistry of the systems discussed will be stressed as well as the important physical aspects. Spring.

Prerequisites: Two semesters each of organic and general chemistry.

FCH 571. Wood Chemistry I: General Wood Chemistry ..... (2)

Two hours of lectures. Introduction to carbohydrate chemistry. Chemistry of cellulose, hemicelluloses, and lignin. Cellulose derivatives. Distribution of polysaccharides and lignin in wood. Wood extractives. Chemistry of bark. Formation of heartwood. Wood as a chemical raw material. Fall.

Prerequisite: One or two semesters of a three-credit undergraduate course in organic chemistry.

FCH 572. Wood Chemistry II: Wood and Pulping Chemistry (3)

Three hours of lectures. Introduction to carbohydrate chemistry. Chemistry of cellulose, hemicelluloses, and lignin. Cellulose derivatives. Distribution of polysaccharides and lignin in wood. Wood extractives. Chemistry of bark. Formation of heartwood. Wood as a chemical raw material. Chemistry of the industrial pulping processes with emphasis on sulfite and kraft pulping of wood. Chemistry of the major bleaching agents. Chemical byproducts in the pulping industry. Complete tree utilization in the manufacture of pulp and paper. Fall.

Prerequisite: One or two semesters of a three-credit undergraduate course in organic chemistry.

FCH 573. Wood Chemistry III: Biosynthesis of Wood ...... (2)

Two hours of lecture. Chemistry of pectin and starch. Photosynthesis with emphasis on the chemical phase. Chemistry of the primary cell wall in plants. Biosynthesis of cellulose, hemicelluloses, pectin, and starch. Biosynthesis of aromatics, including lignin. Biodegradation of wood. Spring;

Prerequisite: FCH 571 or an equivalent course in general wood chemistry.

FCH 600. Interrogating Computer-Based Chemical Science Databases .... (1)

One hour of lecture per week and scheduled time on the computer facilities for solving the assignments. A review of manual searching methods and the structure of the chemical abstracts in its text form. Principles and practice in computer-aided searching of the chemical science, especially chemical literature. A term project requires each student to design, conduct and analyze a literature search. Structured problems in computerized literature searches will also be assigned. Both structure and concept-based methods of searching will be treated. Fall.

Prerequisite: Graduate standing in chemistry or permission of the instructor.

FCH 630. Plant Biochemistry .... (3)

Three hours of lecture and discussion. Includes the biochemistry of photosynthetic electron transport and phosphorylation,, photosynthetic carbon fixation, photoespiration, nitrogen fixation,, nitrate reduction, photochrome, and plant hormones. The economic,, ecological and environmental aspects of plant biochemistry will also be discussesd. Spring.

Prerequisites: FCH 530-532 or FCH 539 or equivalent.

FCH 643. Chemical Activities of Microorganisms .... (3)

The microbial world. Intrinsic antigens, enzymes, and toxins. Overproduction of agonists, antagonists and semiochemicals. Selected elicitorreceptor interactions. Regulation of primary and secondary metabolite formation. General type reactions and bioconversions of steroids, vitamins, nucleotides, and alkaloids. Applications of biocatalysis in semi-synthetic reaction pathways. Ancillary microbiological, genetic, biochemical, and processing technics.

Prerequisites: One year of organic chemistry and FCH 530, 539, or equivalent.

FCH 650. Physical Chemistry of Polymers I .... (3)

Three hours of lecture. Includes: thermodynamics of polymer solutions, phase equilibria, fractionation, structure-property relationships, elementary chain statistics, molecular geometry, network elasticity, polyelectrolyte theory, and viscocity. Fall.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

FCH 651. Physical Chemistry of Polymers II .... (3)

Three hours of lecture. Viscoelasticity. The glassy state and glass transition temperature. The crystalline state and crystalization kinetics. Characterization of structure and morphology of polymer solid states. Survey of structure and properties of native polymers. Spring.

Prerequisites: One year of organic and one year of physical chemistry.

FCH 652. Organic Chemistry of Polymers I .... (2)

Two hours of lecture. A broad survey of the chemistry of polyfunctional molecules and methods for their conversion to high molecular weight materials. Synthesis of a variety of specialty polymers and chemical reactions on natural and synthetic polymers. Some relations between molecular structure and useful properties. Fall.

Prerequisite: One year of organic chemistry.

FCH 653. Organic Chemistry of Polymers II .... (3)

Three hours of lecture. Kinetics and mechanism of polymerization processes, with emphasis on addition polymerization reactions initated by radical, cationic and anionic initators. Mechansim of sterospecific polymerization. Structure of polymers. Reactions on polymers and their modification for specific end uses. Block and graft polymers. Spring.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

FCH 796. Special Topics in Chemistry .... (1-3)
(Credit hours arranged according to nature of topic)

Lectures, conferences, and discussion. Advanced topics in physical chemistry, organic chemistry, or biochemistry. Fall and Spring.

FCH 798. Research in Chemistry
(Credit hours arranged according to nature of problem)

Independent research in physical and organic chemistry of synthetic polymers, physical and organic chemistry of natural polymers, organic chemistry of natural products, ecological chemistry and biochemistry. One typewritten report required. Fall, Spring, and Summer.

FCH 899. Master's Thesis Research ....(Credit hours to be arranged)
Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

FCH 997. Seminar ....(1)
Seminars scheduled weekly; an average of twenty to thirty seminars are given annually. Discussion of recent advances in chemistry. Credit is given only once to a student. Fall and Spring.

FCH 999. Doctoral Thesis Research ....(Credit hours to be arranged)
Research and independent study for the doctoral degree and dissertation. Fall, Spring, and Summer.

FEG—FOREST ENGINEERING

FEG 340. Engineering Hydrology, and Flow Controls ....(4)
Three hours of lecture and three hours of laboratory and discussion. Analysis of the waters of the earth, their occurrence, circulation, and distribution; physical properties and their interaction with their environment. Principles of hydrologic budgeting and routing; and basic hydraulics of open channel, conduit, groundwater and overland flow. Applications of probability as a basis for the design of solutions to groundwater, surface runoff, flooding and water supply problems. Spring.
Prerequisites: CIE 327, IOR 326, and APM 360.

FEG 350. Introduction to Remote Sensing for Engineers ...(2)
Two hours of lecture per week. The fundamentals of acquiring, analyzing, and utilizing remote sensing data in the performance of natural resource inventories, environmental quality surveys and site development analyses. Oriented for multidisciplinary participation.
Prerequisite: Junior standing.

FEG 352. Introduction to Remote Sensing ....(3)
Two hours of lecture and three hours of laboratory per week. Qualitative and quantitative introduction to the fundamentals of acquiring, analyzing, and utilizing remote sensing data in the performance of natural resource inventories, environmental quality surveys, site development studies, and land use analyses. Oriented for multidisciplinary participation. Fall and Spring.
Prerequisites: Junior standing, physics and calculus or consent of the instructor.

FEG 363. Photogrammetry I ....(3)
Two hours of lecture and discussion, three hours of laboratory. Basic photogrammetric and photo interpretation concepts as a means of acquiring reliable data for engineering and management planning. Potentials, limitations, instrumentation, and unique requirements are considered. Fall or Spring.
Prerequisite: ERE 371 or equivalent.

FEG 410. Structures ....(4)
Three hours of lecture, three hours of computation laboratory and discussion. Engineering principles in the analysis, planning design and construction of components and framed structures under various types of loadings. The proportioning of wood, steel and concrete members and the design of statically determinate structural systems. Emphasis is placed on the relationship between theoretical stress analysis and codes and specifications for appropriate materials and structural design practices. Fall.
Prerequisites: ERE 362, APL Computing.

FEG 420. Harvest Systems Analysis ....(1)
Three hours of discussion, demonstration and/or field exercises. An introduction to mensuration, harvesting operations, methods analysis, mechanization, and interrelationships between the production and silvicultural aspects of harvesting, is presented. A context is developed for the application of other Forest Engineering courses.
Prerequisites: FOR 321, ERE 362.

FEG 430. Engineering Decision Analysis ....(3)
An introduction to the design process as a decision model, with emphasis on determining economic attractiveness of engineering projects, and evaluation of investment alternatives. Analysis of production and construction activities in private and public works activities. Fall.
Prerequisite: IOR 326.

FEG 437. Transportation Systems ....(3)
Two hours of lecture and three hours of laboratory. Interrelationships between natural features, transportation types, design, and management objectives to provide the most effective system within a given framework. Basic engineering principles in the planning, location, design, construction, and maintenance of suitable transportation systems to serve various aspects of forest resource management.
Prerequisites: ERE 371, CIE 437, FEG 340.

FEG 448. Advanced Topics in Hydraulics ....(3)
Three hours of lecture per week. Classroom instruction and exercises introduce advanced concepts in hydraulics. Topics include the energy and momentum principles, critical flow, uniform flow, flow profiles, and unsteady flow, as appropriate. Suitable as an engineering design elective in the forest engineering curriculum. Fall.
Prerequisite: FEG 340 or equivalent as determined by the instructor.

FEG 454. Power Systems ....(2)
Two hours of lecture per week. Application of alternative technologies to the matching of power needs and resource constraints. Topics include tractive power, wind power, cogeneration, alternative fuels, and photovoltaics.
Prerequisites: MEE 285, ERE 351, FEG 420.

FEG 464. Photogrammetry II ....(3)
Two hours of lecture and three hours of laboratory. General analytic photogrammetry including interior and exterior orientation systems, intersection, space resection, and orientation. Correction of photo coordinates for film deformation, lens distortions, atmospheric refraction, andearth curvature. Introduction to photogrammetric plotters. Planning for photogrammetric projects and designing optimum procedures for selected photogrammetric tasks. Fall.
Prerequisite: FEG 363.

FEG 489. Forest Engineering Planning and Design ....(3)
Two hours of lecture and three hours of laboratory. A curriculum capstone course designed to integrate other coursework with a systematic approach to real life engineering problems. Semester-long laboratory projects are selected to provide experience in dealing not only with technical and economic constraints, but also with environmental, social, legal, and political aspects of the planning process. Spring.
Prerequisite: Senior standing in forest engineering.

FEG 498. Research Problem in Forest Engineering ....(1-3)
Independent research in topics in Forest Engineering for the highly motivated undergraduate student. Selection of subject area determined by the student in conference with appropriate faculty member. Tutorial conferences, discussions and critiques scheduled as necessary. Final written report required for departmental record. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor.

FOR—FORESTRY (RESOURCES MANAGEMENT)

FOR 200. Introduction to Resources Management ....(2)
Two-three hours of lecture/discussion. An introduction to forestry and the professional disciplines related to forest resources management. Topics include the scope and purposes of forestry, application of basic scientific concepts in planning forest resources management, approaches to integrating the

managemnet of forest-related resources and values, professionalism and ethics, and a review of current issues of importance to forestry. Required for resources management students and highly recommended for Dual EFB/FOR students. Open to all other students. Fall.

FOR 205. Introduction to Macroeconomics......(3)
Three hours of lecture per week. The role of macroeconomic theory in public policy will be emphasized. Basic macroeconomic models of the banking system and of the interplay of consumer, business firms and government purchases of goods and services will be used in the analysis of public policy with respect to stability of consumer prices and the level of employment in the economy, the role of foreign trade in the performance of the national economy.

FOR 206. Introduction to Microeconomics ......(3)
Three hours of lecture per week. Consumer behavior, pricing and resource allocation, and the theory of the firm and industry will be emphasized. The role of microeconomic theory in public policy analysis.

FOR 301. Field Dendrology ....(1)
Approximately one half-day lecture, five eight-hour field study, presented as the first portion of the Summer Program in Field Forestry held at Pack Demonstration Forest, Warrensburg, N.Y. Field identification and ecology of common woody species of the southeastern Adirondack area. Natural and cultural history of the area as it affects the growth and development of these species. Summer.

FOR 302. Forest Surveying and Cartography ....(2)
Course consists of approximately 13 eight-hour class days, combining lectures and practical field applications. The course stresses development of functional ability in the areas of cartography, overland navigation, and land measurement. It is part of the Summer Program in Field Forestry held at Pack Demonstration Forest, Warrensburg, N.Y. Summer prerequisite for FOR 303, 322, 332.
Prerequisite: FOR 301.

FOR 303. Introduction to Forest Resource Measurements (Summer Field Session) ....(3-1/2)
Lecture and field practice on methods and procedures for measuring trees, forest stands, and forest products. Descriptive statistics and sampling are introduced as they relate to the measuring process. Emphasis is placed upon field procedures and performance.

FOR 304. Introduction to Forestry ....(1)
Approximately one day of lecture and at least four all day field trips, presented as an integral part of the Summer Program in Field Forestry. Students will be introduced to the diversity of forestry and the activities of a professional forester, and will visit forestry field operations and woodusing industries. Summer.

FOR 305. Forestry Concepts and Issues ....(1)
Three hours of lecture/discussion; starts approximately mid-semester. An introduction to environmental attitudes and values as they relate to forestry and natural resource professionalism and practice. Current issues are used as examples. Required for Resource Management juniors and Dual RM/Forest Biology students. Fall.

FOR 307. Environmental Economics ....(3)
Three hours of lecture and discussion per week. Economic theory and analysis in the control of external economies and diseconomies in the use of resources. Particular emphasis is placed upon the study and application of economic models to the problems of pollution of air, water, and land. Relationships and interactions of the public and private sectors in the creation and control of externalities.

FOR 321. Forest Ecology and Silviculture ......(3)
Two hours of lecture and one three-hour field laboratory first half of semester; three hours of lecture last half of semester. Survey of forest tree and stand ecology and silviculture concepts and implications for treatment of forest stands for various values. Some field evaluation of forest stands, site and history variables, and treatment alternatives. For students outside Resources Management curriculum; not open to students taking FOR 332 and 334. Fall.
Prerequisite: Botany or general biology.

FOR 322. Forest Resource Measurements ....(2)
Two hours of lecture and one three-hour laboratory per week in first two-thirds of semester. Principles and methods used in the measurement of trees and forest stands, theory and application of forest measurements as applied to non-commodity resource uses, and introduction to the concept of forest growth and yield analysis. Fall.
Prerequisite: FOR 303 or equivalent.

FOR 331. Forest Influences ....(3)
Two lecture/discussion sessions and one laboratory/field session per week. Forest vegetation as a modifier of the local fluxes of energy and water. Required for Resource Management juniors and Dual RM/Forest Biology students. Fall.

FOR 332. Silvics ....(3)
Three hours of lecture, or two hours of lecture with three hours of laboratory per week. Course stresses understanding of autecology and synecology as they apply to the creation of specific forest stand structures, dictated by varying management objectives (recreation, water, wildlife, wood).
Prerequisites: Botany and general ecology.
Corequisites: Soils, and forest influences (or equivalent prerequisites).

FOR 333. Silvics/Lab Practicum ....(1)
Five hours of field/laboratory exercise per week in selected weeks. Course stresses practical experience as a means to increase understanding and articulation of: 1) autecology and synecology, and 2) the creation of specific forest stand structures dictated by varying management objectives (recreation, water, wildlife, wood). Computer methods, problem analysis techniques, and a professional seminar are part of the practicum.
Prerequisites: Botany and general ecology.
Corequisites: Silvics, soils, and forest influences (or equivalent prerequisites).

FOR 334. Silviculture ....(4)
Three hours of lecture and 3 hours of laboratory or field trip per week. Study of the practice of silviculture for managing forest stands to serve various interests of landowners. Field trips and exercises provide opportunities to see examples of common silvicultural methods under different management scenarios, and to learn and practice techniques for analyzing forest stands and developing prescriptions for their treatment. Fall.
Prerequisite: Concurrent or earlier courses in forest soils, forest in-fluences, silvics, and forest mensuration, or equivalent.

FOR 335. Regional Silviculture ....(3)
Three hours of classroom study. Topics cover regional factors that influence silvicultural methods commonly used in different forest types. Provides study of various silvicultural systems used in operating forest properties in various regions, with attention to geographical differences in land use, market opportunities, species characteristics, and economic conditions. Spring.
Prerequisite: FOR 332 or FOR 321.

FOR 341. Watershed Hydrology and Water Quality ....(1-3)
One to three hours of lecture in classroom and field. Basic principles of watershed hydrology, natural water quality, and interactions between rural lands' management practices and water quality, especially the substantive basis underlying and best management practices for application of agricultural and

silvicultural nonpoint sources on rural lands.

Prerequisite: Permission of the instructor.

FOR 345. Soils ....(3)

Two hours of lecture and three hours of laboratory. Introduction to the fundamentals of soil science with particular reference to forestry, but including other land uses. Fall.

FOR 360. Principles of Management ....(3)

Three hours of lecture and recitation. Basic principles and concepts of management which are universally applicable to any organization, business enterprise, or public agency. The various approaches to management including the classical, behavioral and quantitative concepts with emphasis upon the integrative approach, now required to meet modern society's changing life styles and values and the new awareness of the public regarding environmental matters and natural resources management. Spring.

FOR 361. Computing in Forestry..................(3)

Introduction to the use of the computer in forestry and to the BASIC programming language. Commonly used forestry techniques are implemented by the student on the computer and the student has the opportunity to use other professionally prepared programs. The student also uses the computer as a communication device. The course is designed for students in the forestry curriculum. Open to other students by permission of the instructor.

Prerequisite: An introductory course in computers.

FOR 363. Management Models ....(3)

Introduction to the various models used in managerial decisionmaking. Emphasis is on the characteristics of the various models: Their formulation, assumptions, uses and limitations. The major topics covered will include: The role of models in management; simple optimization; constrained optimization; multi-valued choices; time adjustment of value; simulation; and models in nondeliberated decisions. Integration of the deliverative and intuitive models is stressed. Spring.

FOR 364. Soil and Water Conservation Policy ....(3)

Three hours of lecture. An integrated, historical survey of water and related land resource conservation in the United States. Interrelationships of governments and private organizations in their functions of policy-setting and planning, administration of programs, and evaluation of projects. Three lectures per week. Spring.

FOR 373. Timber Harvesting ....(3)

Two hours of lecture and one three-hour laboratory and discussion. Harvesting as a production system including equipment, equipment mixes, costs and manpower in serving and logmaking and primary and secondary transportation. Evaluation of various systems as to environmental impacts. Wood as a raw material to the primary processing system and trees as inputs to the harvesting system. Spring.

FOR 378. New York Forestry ....(3)

Lecture, discussion, and field trip. Historical development of forests and forest uses in New York, analysis of current issues in New York forestry, and consideration of possible future developments for New York forests. Provides information useful to geographers, foresters, planners, and others interested in the social environment of New York's natural resources.

FOR 400. Forest and Resource Economics ....(3)

Three hours of lecture/discussion per week. This course examines the applications of principles and models of economics to planning and management of forest and related natural resources. Applications to timber, wildlife, water, and outdoor recreation are stressed. Market and nonmarket analyses are covered.

Prerequisite: Senior status in forest resource management, open to others with permission of the instructor.

FOR 404. Economics of Wood-Using Industries (3)

Three hours of lecture and discussion. Structure and organization of selected wood-using industries. Analysis of decisionmaking by the firm. Principles of production and marketing including demand and cost analysis and pricing. Special issues and current problems of the industries, and introduction to the newer mathematical and statistical tools for meeting them. Spring.

Prerequisite: Microeconomics.

FOR 405. World Forestry Resources: Problems and Prospects....................................(3)

Three hours of lecture and discussion plus guided readings, pertaining to world forest resources and the problems and opportunities associated with their use and development. Major topics include: world forest resources; production and trade; principal wood-producing countries; forestry and the problems of underdevelopment; and special areas and topics of interest to world forestry. Spring.

Prerequisite: Senior status preferred.

FOR 433. Commodity Production Silviculture .(3)

Three hours per week of lecture and discussion stressing the development of prescriptions and the application of silvicultural techniques, primarily for commodity production. Topics include even-aged stand development, intermediate stand treatments, growth and change in uneven-aged stands, natural reproduction methods, assessing tree and stand quality and value, and application of selection system. Students undertake projects as a means for developing deeper understanding of and a capacity for prescribing different silvicultural techniques. Spring.

Prerequisites: FOR 334 and FOR 370, or equivalent. Senior standing required.

FOR 446. Forest Soil Classification, Survey, and Interpretation ....(3)

Three hours of lecture and discussion, one three-hour laboratory. Detailed examination of soil genesis and classification, and the survey and description of the soilscape. Interpretations are made for various land uses, especially forestry. Fall.

Prerequisites: FOR 331 or 345 or an introductory soils course.

FOR 455. Forest Tree Improvement ....(3)

Two hours of lecture, three hours of laboratory or field work. General principles and methods of tree improvement as practiced in this country and abroad. Tree selection techniques of vegetative propagation, hybridization, polyploidy, establishment and management of seed orchards, clonal and progency testing and other problems. Spring.

Prerequisites: FBL 470, or Introduction to Mendelian Genetics or Population Genetics.

FOR 465. Natural Resources and Environmental Policy ....(3)

Three hours per week of lecture and discussion. Course examines the working principles creating the structure of natural resource and environmental policy. Specific laws and policies are analyzed as a product of complex history of policy processes spanning common law, legislation, administration, court decisions, local zoning, and economic relationships. Applies basic analytical skills to policy questions. Explores the relationship of the manager to policy processes. Required of seniors in Resources Management and of Environmental Studies students in the Policy and Management Study Area; open as an elective to other undergraduates.

Prerequisite: Senior status, one semester in both economics and U.S. government.

FOR 470. Management of the Forest Enterprise ....(3)

Two hours of lecture and one discussion/laboratory. This course is concerned with the management alternatives, both of a technical and social nature that are available in the planning for and the production of timber, recreation, wildlife, forage and water from the forest and with the criteria for choice to meet management objectives. Fall.

FOR 472. Fundamentals of Outdoor Recreation ....(3)

Three hours of lecture. Introduction to the programs and practices of federal, state, and local agencies and private organi-

zations involved in planning, administration, and management of outdoor recreation areas. Emphasis is on major recreational issues and conflicts faced by area managers, and how they integrate solutions into their plans. Spring.

FOR 473. Planning and Development of Forest Recreation Areas ....(3)

Three hours of lectures or equivalent laboratory and assignments. Planning and designing forest recreation areas, structures, and facilities. Development of construction plans for camp and picnic sites, for waterfront areas and for trails. Emphasis is on the functional relationship between planning and design, management, and maintenance. Field trips required. Fall.

Prerequisite: FOR 472.

FOR 474. Commercial Recreation ....(3)

Three hours of lecture and discussion per week, plus one all-day field trip. Introduction to the role of the private sector in providing recreational facilities, programs, and services. Case studies of private recreation enterprises. Emphasis on the requirements for successful commercial recreation ventures. Fall.

Prerequisite: FOR 472 or equivalent.

FOR 475. Sociology and Psychology of Leisure Behavior ... (3)

Three hours of lecture and discussion. Introduction to theory and research findings dealing with the sociological and psychological aspects of leisure behavior; field work and lectures demonstrate applications, particularly with regard to leisure behavior. Spring.

Prerequisites: FOR 472, and an introductory course in sociology or psychology, or permission of the instructor.

FOR 477. Resource Policy and Management ....(3)

Three hours of lecture supplemented by one hour of discussion and/or lecture. Public and private forest policy formation; principles of modern management; overall management and operation of a productive forest property. Primarily for forest engineers. Not available to Resource Management undergraduates. Fall.

Prerequisites: Mensuration and silviculture, senior standing in Forest Engineering, or by permission of the instructor.

FOR 478. Wilderness and River Recreation Management ... (3)

Three hours of lecture and discussion per week. Introduction to the federal and state legislation and institutional framework that affects wilderness and river recreation planning and management. Emphasizes dispersed recreation planning, site management, visitor management, carrying capacity, and wilderness and river recreation management plans. One two-day field trip required. Spring (odd years).

Prerequisite: FOR 472 or equivalent.

FOR 480. Urban Forestry ....(3)

Two hours of lecture, and one hour of discussion or three hours of field study per week. Evaluation and management of urban greenspace resources, with emphasis on trees, in the context of other values and management processes in urban areas. Field practice in evaluating urban greenspace and tree resources. Shared resource course meeting with FOR 680 which has additional requirements. Spring.

Prerequisites: Senior status. FOR core courses or permission of the instructor for seniors in other programs.

FOR 496. Special Topics in Resource Management/Forestry .. ..(1-3)

Experimental and developmental courses in new areas of resource management/forestry or areas not covered in regularly scheduled courses. Topics may include but are not limted to the biological, physical, and social dimensions and the many and varied resources of forest lands and forestry. Specific detailed course descriptions for each course taught under the 496 designation are available for student perusal. Fall, Spring, and Summer.

FOR 498. Independent Study in Resource Management/Forestry....(1-6)

Independent research or study in resource management/forestry for selected undergraduate students. Selection of subject area, nature of the research or study, and number of credit hours determined by student in conference with appropriate faculty member; initiative in taking FOR 498 rests with the student. Final written report is required for record. Fall, Spring, and Summer.

Prerequisite: Cumulative G.P.A. of at least 2.50 and approval of the advisor and instructor.

FOR 499. Independent Study/Internship in Resource Management/Forestry ....(7-12)

Independent research or study in resource management/forestry for selected undergraduate students especially designed for internships spent off-campus working for a resource management or forestry oriented firm or organization while also pursuing an academically oriented project. The selection of the study topic will be determined by the student in consultation with his/her advisor. Guidance will be provided by a faculty committee. Final written report is required for record. Limited to seniors in resource management/forestry. Fall, Spring, Summer.

Prerequisite: Must have a cumulative G.P.A. of at least 3.00

FOR 520. Application of Ecology..................(3)

Two hours of lecture and discussion and one to three hours seminar, workshop, or field trip. Exploration of use and implications of ecological concepts for practices modifying terrestrial ecosystems for human benefit. Discussion of ecological writings in relation to applied problems; workshops, field trips, and student presentations exploring ecological implications of specific situations. Course designed for interdisciplinry participation. Spring (even years).

FOR 534. Greenspace Silviculture ....(3)

Two hours lecture; three hours field laboratory or two hours discussion per week. Concepts, techniques, and field practice of evaluating and managing vegetation systems, including site resources, woody and herbaceous vegetation, and use impacts, primarily for on-site, greenspace values on recreation, wildlife and multiple-use lands; ; roadsides and utility rights-of-way; buffer and protection areas, etc.. Fall.

Prerequisites: Graduate status and coursework in silviculture and soils. Qualified seniors by permission of the instructor.

FOR 535. Advanced Forest Soils ....(3)

Three hours of lecture-discussions concerning the current state-of-the-art in forest soils. Effect of intensive forest management on soil, soil-site-species relationships, forest fertilization tree nutrition. Application of forest soils information to silviculture. Spring.

Prerequisite: FOR 331, 332 or beginning courses in soils and silviculture.

FOR 536. Forest Planting ....(3)

Two hours lecture and three hours laboratory or field average per week, including up to two all-day field trips. Concepts and techniques of forest planting for land rehabilitation and as a silvicultural system;; including species and genetic selection, seed and plant production and evaluation, planting methods and site preparation, and regional case studies. Spring.

Prerequisites: Graduate status and coursework in silviculture. Qualified seniors by permission of the instructor.

FOR 540. Forest Hydrology ....(3)

Two hours of lecture and three hours of laboratory The relation of forest and range vegetation to its environment, and its effect upon soil and water. Measurement of precipitation, runoff, erosion, and other variables. Fall.

FOR 542. Practice of Watershed Management ....(3)

Two hours of lecture and three hours of laboratory. The impact of the multiple use of forest and range lands on water yield and soil stability. Regional problems and potential solutions. Fall.

Prerequisite: FOR 540.

FOR 550. Environmental Impact: Principles and Strategies ....(3)
Three hours of lecture and discussion. Principles and theory of environmental impact and statements of impact as required by federal law. Administrative procedures for review and evaluation. Procedural strategy and effective constitution of statements for various governmental levels. Means of obtaining sources of authoritative information. Fall.
Prerequisite: Senior standing.

FOR 561. Land Use Economics ....(3)
Three hours of lecture/discussion per week. Study of the theory and method of land use economics and the application of economic analysis to open space and regional planning. Emphasis is on understanding basic concepts, development of operational methods and data sources. Case studies, outside readings, and guest speakers are utilized. Spring.
Prerequisite: One course in microeconomics.

FOR 562. International Timber Trade ....(3)
Three hours of lecture. Basic principles of international trade. Structure and procedures of international timber trade. Major trade regions and their relationships. Economic context of timber trade. Emphasis is placed upon methods of analyses for understanding both opportunities and limitations of timber products exports and imports. Fall.
Prerequisites: Two semesters of undergraduate economics, and senior standing in forestry or wood products engineering.

FOR 572. Outdoor Recreation Management ....(3)
Three hours of lectures per week. Description of specific methods and techniques used in outdoor recreation management. Discussion of practices applicable to resource, visitor, and service management. Spring.
Prerequisite: FOR 472, or equivalent.

FOR 587. Environmental Law ....(3)
Three hours of lecture and discussion. Studies in Environmental Law designed for resource managers. Review of structure and processes of American legal system, constitutional framework of environmental law, The National Environmental Policy Act, legal framework for management of federal lands, focus on legal aspects of common property resource management, land, water, and air. Fall.

FOR 588. The Law of Natural Resource Administration ....(3)
Three hours of lecture and discussion. An introduction to the law concerning the procedures, powers, and judicial review of public agencies responsible for the management of natural resources. Topics will include the extent of an agency's rule-making power and the rights of aggrieved parties to appeal from agency decisions. Spring.
Prerequisite: FOR 360 or equivalent course in public administration.

FOR 591. Oral Presentation Techniques ....(1)
Course meets one hour weekly for presentation and discussion. Course objective is improvement of presentation style and articulation skills through preparation, delivery, and interactive evaluation of information style seminars.
Prerequisite: Graduate standing and permission of the instructor.

FOR 592. Written and Oral Argumentation ....(2)
Course meets two hours weekly. Course objective is to improve articulation skills through effective argumentation. Students will participate in weekly discussions of the assigned readings, and each student will prepare, present, and support two position papers to a *review panel consisting of students and faculty within the class.*
Co- or *Prerequisite:* FOR 591 - Oral Presentation Techniques.

FOR 600. Field Applications in Forest Management and Operations ....(3)
Equivalent of three weeks of lectures, seminars, and field trips related to the management and utilization of the high value forest resources of the Allegheny Basin region. This course is the required entry point to the M.F. program and is taught during summer at the Allegany State Park near Salamanca, NY.
Prerequisite: Matriculation in the M.F. program - open to others by permission of the instructor.

FOR 601. Resource Information for Forest Management ....(3)
Three hours of lecture, discussion, or laboratory work per week. Introduces the student to the characterization of biophysical and socioeconomic resources, their inventory and compilation into a geographic information system as an application of database management, and their evaluation and analysis for incorporation into the forest management decisionmaking process.
Prerequisite: Matriculation in the M.F. program - open to others by permission of the instructor.

FOR 602. Forest Resource Economics ....(3)
Three hours of lecture, discussion, or laboratory work per week. Provides students with analytical tools in forestry economics for analyzing and evaluating forest management operations. Provides an understanding of the operation of the economic system within which forest resources are found.
Prerequisite: Matriculation in the M.F. program - open to others by permission of the instructor.

FOR 603. Advanced Silviculture ....(3)
Applications of basic principles and practices of silviculture within forest stands in accordance with and dictated by varying forest resource values and ownership objectives. Four hours of lecture and discussion per week for the first portion of semester, followed by six weekly hours of laboratory/field practicum thereafter. Field trips and lectures by guest experts. Several written and oral presentations required. Fall.
Prerequisite: Matriculation in the M.F. program - open to others by permission of the instructor.

FOR 604. Forest Policy ....(3)
Three hours per week of lecture, discussion, and recitation. Course content brings students to an advanced level of understanding of policies, the nature of issues, the institutional framework for policy evaluation. Emphasizes policy roles and functions in management, interrelationships, information resources, public input, and policy analysis for effective professional contributions in forest policy matters.
Prerequisite: Matriculation in the M.F. program - open to others by permission of the instructor.

FOR 605. Advanced Forest Management ....(3)
Equivalent of three credit hours per week of lecture and recitation. Provides students with the foundation necessary for the management and administration of a complex enterprise involving the use of forestland. Emphasizes the inherent multiresource nature of forest management; the diverse activities involved in producing outputs and services from forestland; and the managerial and technical skills required in planning, directing, and controlling those activities.
Prerequisite: Matriculation in the M.F. program - open to others by permission of the instructor.

FOR 606. Human and Organizational Behavior ....(3)
Three hours per week of lecture and recitation. Provides advanced students with knowledge of the interactions of individuals within organizational settings. Emphasizes the interdependency of people and organizational structures and requirements, and the role of management in facilitating harmonious mutual goal achievement. Deals with the nature and meaning of work, motivation, individual performance, job satisfaction, informal organiza-

tions, work environment, reward systems, controls, work stress.

Prerequisite: Matriculation in the M.F. program - open to others by permission of the instructor. Prior basic course in management principles highly desired.

FOR 610. Field Applications in Integrated Forest Management ....(3)
Two weeks of field trips, discussions, and problem analyses of operating forest systems in the Northeastern United States. Provides an intregation and field application of material in the courses in the M.F. program.

Prerequisite: Matriculation in the M.F. program - open to others by permission of the instructor.

FOR 620. Silviculture Concepts and Applications. ....(3)
Three hours per week of lecture and discussion stressing the conceptual basis for developing prescriptions and applying silvicultural techniques, primarily for commodity production. Topics include even-aged stand development, intermediate stand treatments, growth and change in uneven-aged stands, natural reproduction methods, assessing tree and stand quality and value, and application of selection system. Students undertake independent research projects as a means for developing deeper understanding of silvicultural concepts, and to improve their capacity for prescribing different silvicultural techniques. Spring.

FOR 625. Productivity of Forest Stands ....(3)
In two hours of lecture and three hours of laboratory, whole tree, stand, and forest community productivity are studied from an ecophysiologicalviewpoint. Quantitative techniques and methods used to evaluate biological as well as economic forest production are learned and utilized. From the perspective established, new trends and developments in silvicultural practice are critically examined. Spring.

Prerequisite: Permission of the instructor.

FOR 630. Tropical Forest Ecology and Land Use ....(2)
Two hours of lecture and discussion per week. Tropical forest environments and associated vegetation are studied from an ecological perspective and development options evaluated: agriculture, natural forest and plantation management, agroforestry, pasturing livestock, and forest preservation. Fall (even years).

Prerequisites: Coursework in ecology, soils, and silviculture is recommended, but not required.

FOR 635. Forest Soils and Their Analyses.................(3)
One hour of lecture, one hour of recitation, four hours of field and laboratory study of forest soils, emphasizing plant-soil relationships. Stress on quantification of plant-soil diagnostic techniques and their interpretation. Spring (odd years).

Prerequisites: FOR 446; background in physical and biological recommended.

FOR 640. Advanced Wildland Hydrology ....(3)
Lecture, discussion, and laboratory sessions in advanced problems of forest and range hydrology, watershed management methods, and techniques and evaluation of new methods of hydrologic data collection and analysis. Fall.

Prerequisite: SIL 540 or FEG 340.

FOR 641. Watershed Hydrology and Water Quality ....(3)
Three hours of lecture in classroom and field. Basic principles of watershed hydrology, natural water quality, and interactions between rural lands' management practices and water quality, especially, the substantive basis underlying and Best Management Practices for application of agricultural and silvicultural nonpoint sources on rural lands.

Prerequisite: Permission of the instructor.

FOR 642. Snow Hydrology ....(3)
Three one-hour lectures and two three-day field trips. Physical characteristics of snow and the energy relations important in its accumulation and dissipation. Problems of measurement and prediction of runoff and melt. Potentials for management. Spring.

Prerequisite: SIL 540 or FEG 340.

FOR 655. Advanced Forest Tree Improvement ....(3)
Two hours of lecture and discussion and three hours of laboratory. A study of advanced principles and techniques for genetic improvement of forest trees. Special emphasis is placed on selection and breeding for growth rates, wood quality, and insect and disease resistance. Problems of tree hybridization, racial variations, sexual reproduction, and quantitative genetics in forest trees. Laboratory training in pollen germination, vegetative propagation and other problems. Independent research problems will be undertaken by the student. Fall.

Prerequisites: FBL 470 and 471, FOR 455.

FOR 664. Soil and Water Conservation Policy ....(3)
One three-hour meeting per week. An integrated, historical survey of water and related land resource conservation in the United States. Interrelationships of governments and private organizations in their functions of policy-setting and planning, administration of programs, and evaluation of projects. Fall.

FOR 665. Natural Resources and Environmental Policy ....(3)
Three hours per week of lecture and discussion. Course examines the working principles creating the structure of natural resource and environmental policy. Specific laws and policies are analyzed as a product of complex history of policy processes spanning common law, legislation, administration, court decisions, local zoning, and economic relationships. Applies basic analytical skills to policy questions. Explores the relationship of the manager to policy processes. Shares lecture with FOR 465, but has a separate discussion/seminar section and requires more in-depth readings and a policy analysis paper of a selected topic.

Prerequisite: Graduate status, one semester in both economics and U.S. government.

FOR 670. Resource Economics ....(3)
Three hours of lecture and discussion per week. Economic theory and analysis in resource management and use decisions. Study and application of economic models to land, water, forest, wildlife and recreational resources. Relationships and interactions of public and private sector in resource management. Fall.

Prerequisites: Two semester courses of undergraduate economics.

FOR 671. Economics of Nonmarket Goods ....(3)
Group discussion, lectures, guided readings, case studies, and student projects on the economic aspects of watershed management, fish and wildlife management, and outdoor recreation. Major topics include theories of valuation and application to nonmarket goods, cost analysis for nonmarket goods, and techniques for valuing nonmarket goods and services.

Prerequisites: FOR 670 or microeconomics or permission of the instructor.

FOR 672. Open Space Planning ....(3)
Three hours of lecture and discussion; one overnight field trip required. Study of methods and techniques applicable to open space planning in nonurban areas. Survey of literature and current research. Open space standards, classification systems, and inventory methods. Development of plans for large scale recreational areas, and inclusion of recreation into regional plans. The interrelationship and conflicts between resource utilization/development and recreation/aesthetics reviewed through case studies. Fall (odd years).

FOR 674. Commercial Recreation ....(3)
Three hours of lecture and discussion per week, plus one all-day field trip. Provides an overview of the private sector recreational facilities, programs, and services. Reviews the requirements for successful commercial recreation ventures. Quantitative analysis related to business feasibility is emphasized. Fall.

Prerequisite: FOR 472 or FOR 572 or equivalent.

FOR 675. Psychology of Leisure Behavior......(3)
Three hours of lecture and discussion. Introduction to theory and research findings dealing with the sociological and psychological of leisure behavior: field work and lectures demonstrate applications, particularly in outdoor recreation. Fall.

FOR 676. Regional Development and Tourism ..(3)
Three hours of lecture/discussion per week. Study of the basic concepts of tourism as an important economic and social activity, and its place in regional resource development plans. Overnight field trip required. Spring (odd years).
Prerequisite: Permission of the instructor.

FOR 678. Wilderness and River Recreation Management ....(3)
Three hours of lecture and discussion per week. Reviews the institutional framework that affects wilderness and river recreation planning and management. Emphasis is on understanding management appropriate for dispersed recreational areas in forest and river environments and how planners and managers can use related research information. One two-day field trip required. Spring (odd years).
Prerequisite: FOR 472 or FOR 572 or equivalent

FOR 680. Urban Forestry ....(3)
Two hours of lecture, and one hour of discussion or three hours of field study per week. Evaluation and management of urban greenspace resources, with emphasis on trees, in the context of other values and management processes in urban areas. Field practice in evaluating urban greenspace and tree resources. Shared resource course meeting with FOR 480, with additional requirements for FOR 680. Spring.
Prerequisites: Permission of the instructor.

FOR 691. Research and Evaluation Techniques in Recreation ....(2)
Two hours of lecture and discussion per week. An introduction to the design of research and evaluation projects to assist recreation planning and management in the public and private sectors. Emphasis is on understanding the process of design, measurement, and analysis to achieve effective techniques and applications in recreation. Spring (even years).
Prerequisite: Graduate status and previous recreation courses.

FOR 696. Special Topics in Forestry......................(1-3)
Experimental and developmental courses in new areas of forestry not covered in regularly scheduled courses. A course syllabus will be available to students and faculty advisors prior to registration.

FOR 697. Seminar ....(1)
Group discussion and individual conference concerning current topics, trends, and research in management. Fall and Spring.

FOR 735. Forest Soil Fertility (Applied Studies) ....(2-4)
Two hours of lecture and one hour of discussion. Up to six hours of laboratory depending on number of credit hours. Influence of soil fertility on development and growth of seedlings and trees, and techniques involved to determine this influence. Chemical and biological analysis to determine levels of soil fertility. Nutrient element deficiencies and their correction by soil amendments and fertilizers. Term projects by the student will be undertaken. Spring (even years).
Prerequisites: CHE 332 and 333, FBO 530, FOR 446 and FOR 635, or equivalent.

FOR 737. Forest Soil Physics ....(4)
Three hours of lecture and discussion and three hours of laboratory. Presentation of principles of soil physics including water flow, strorage and availability, soil permeability, heat transfer, and their consideration as root environmental factors. Analytical procedures are introduced and evaluated. Applications of soil physics to silvics, soil fertility, watershed management and hydrology, soil biology, and land-use. Spring (odd years).
Prerequisites: FOR 345, 446, or their equivalents. Physical chemistry and integral calculus strongly recommended.

FOR 751. World Forestry ....(3)
Three hours of lecture and discussion. Worldwide forest classification and geographic distribution; comparative study of forest policies and management systems; tropical forestry and deforestation; agroforestry; international timber trade; forest resources and economic development; technology transfers; United States' role in less developed countries' forestry. Spring.

FOR 753. Advanced Natural Resource and Environmental Policy......................(3)
Three hours per week of lecture and discussion. Course takes a social history approach to examine the working principles forming the foundation for natural resource and environmental policies. These principles will be directed toward an appreciation of the institutional context for the domestic and global natural resource and environmental issues, and an understanding of the values, institutions, policies, and rules which govern societies and their relationship to their environment.
Prerequisite: Graduate status, highly desired is previous coursework in public policy, natural resource or environmental policy, environmental law, public administration, or property law. For Continuing Education students, experience in public policy, environmental regulation, or government is desirable.

FOR 754. Advanced Forest Administration ....(3)
Critical appraisal of existing public, semipublic and private forest agencies in the United States, and the comparative study of major administrative organizations and practices. Occasional inspection trips to forestry headquarters and field units and discussion of internal administrative problems with forest officers. Fall or Spring.
Prerequisite: FOR 360 or equivalent.

FOR 796. Special Topics in Forest Resources Management ....(1-3)
Lectures, seminars, and discussion. Advanced topics in resource management and policy. Check schedule of classes for details of subject matter. Fall and/or Spring.

FOR 797. Seminar ....(1)
Individual presentation and group discussion concerning current topics of concern to natural resources or their management. Fall and Spring.

FOR 798. Research Problems in Forestry.................(1-6)
Special investigation and analysis of forest resource management topics. A study plan and a final written report are required. Fall and Spring.

FOR 895. Graduate Internship ....(1-6)
Professional experience which applies, enriches, or complements formal coursework. Restricted to Graduate students in Forest Resource Management. Graded on an "S/U" basis. Fall, Spring, and Summer.

FOR 898. Professional Experience.......................(6-12)
Professional experience which applies, enriches, or complements formal coursework. Restricted to M.S. students in Option 2. Graded on an "S/U" basis. Fall, Spring, and Summer.

FOR 899. Master's Thesis or Project ....(1-6)
Investigation leading to the completion of a research-oriented thesis or to an application-oriented project. Graded on an "S/U" basis. Fall, Spring, and Summer.

FOR 999. Doctoral Thesis Research.....................(1-12)
Investigation leading to the completion of the doctoral thesis. Graded on an "S/U" basis. Fall, Spring, and Summer.

FTC—FOREST TECHNOLOGY

FTC 200. Dendrology I ....(2)
Twenty-five hours of lecture and 34 hours of field time. A study of the distinguishing characteristics, growth features, distribution, associates and importance of the major tree species of North America. Seasonal field identification and on-the-spot discussion of habitats, associates, and the place in succession of the predominant forest trees and shrubs as found in the Adirondack area of the Northeast, plus a limited number of introduced species. Fall.

FTC 202. Plane Surveying I ....(5)
Sixty-six hours of lecture and 132 hours of field and laboratory time. An introduction to the theory and practice of plane surveying. Emphasis is on individual skill development through small crew projects, handling typical surveying equipment in typical field situations. Lecture topics include the theory of measurements and errors, mathematics for plane surveying, introduction to field problems and introduction to map use and preparation, United States Public Land Survey System, and concepts of deed descriptions and record keeping procedures. A trip to the County Court House is scheduled for a tour of the Record Room. Field projects include traversing, using forester's and engineer's tools and methods, mapping using field and office methods, and proficiency projects in handling typical surveying instruments. Fall.

FTC 204. Forest Mensuration and Statistics I ....(3-1/2)
Sixty-nine hours of lecture and 46 hours of field and laboratory time. A classroom and field study of the basic principles and skills required for timber measurements. Volume tables, their use and construction, are studied. Cruise reports are required in which the student presents cruise results. Various methods of forest sampling are studied, including methods of calculating necessary sampling intensities and sampling errors. Fall.

FTC 205. Forest Mensuration and Statistics II ....(2)
Four hours of lecture and 60 hours of field and laboratory time. A field problem of practical nature utilizing methods for collecting, analyzing, and presenting data dealing with timber volumes. Spring.
Prerequisite: FTC 204.

FTC 206. Forest Ecology ....(3)
Forty-eight hours of lecture and 52 hours of field time. Study of weather and weather data collection; students monitoring a forest weather station. Study of climate and soil factors, how they affect trees and forests and the interactions both within the forest community and within the forest ecosystem. Introduction to cover type mapping. Final field problem and written and oral report on the detailed analysis of a forest transect. Fall.

FTC 207. Aerial Photogrammetry ....(2)
Twenty-five hours of lecture and 44 hours of laboratory. Development of the ability to interpret important ground features by viewing aerial photos singly and in pairs, using stereoscopic techniques and equipment. Scale problems and the making of reliable horizontal and vertical measurements. Radial line plot control for the transfer of detail to base maps. Forest type mapping and forest mensuration using photos. Fall.

FTC 208. Allied Technologies ....(2)
Twenty-nine hours of lecture and 36 hours of laboratory time. This is a multi-subject course. It provides the student with technical competence in the proper use, design; construction and/or maintenance of forest hand tools, maps and route surveys, trail development and first aid and CPR. Fall

FTC 209. Forest Roads ....(2)
Twenty-two hours of lecture and 34 hours of laboratory time. This course provides the student with the technical competence necessary to administer, locate, and design the construction and maintenance of a typical forest gravel road. Spring.
Prerequisite: FTC 202.

FTC 210. Computer Applications ....(1)
Ten hours of lecture and 20 hours of laboratory time. An introduction to the use of computers, including computer systems, disk operating systems, word processing, development and use of spreadsheets, development and use of a database, and computer applications in forestry and surveying. Fall.

FTC 211. Silviculture I ....(2-1/2)
Forty-one hours of lecture and 54 hours of laboratory. Lectures cover orientation, terminology and present a framework of the various treatments used in many common stand conditions to bring the forest into a more productive state in accord with the objectives of management. Emphasis on thinning in computer simulation and field practice. Exercises in planting and pruning. Demonstrations in chemical silviculture. Spring.
Prerequisite: FTC 206 Forest Ecology.

FTC 213. Forest Entomology ....(1)
Eighteen hours of lecture and 16 hours of laboratory/field time. A study of insects that damage trees and their role in the total forest community. The course covers identification of local forest insects, study of the major pest groups of other forest regions, and control measures including integrated pest management and pesticides. Fall.

FTC 214. Personnel Management ....(1-1/2)
Fourteen hours of lecture; 16 hours of laboratory time. A study of company and agency organization functions, including selection of and placement of personnel, training of personnel and performance evaluations, planning for and administering crew responsibilities, human relations in the working situation, and special personnel problems of the forest are covered. Techniques of foremanship are applied in various field exercises in other courses, along with the study of safety hazards, accident prevention, accident classification, and accident reporting. Spring.

FTC 215. Timber Harvesting ....(2)
Eighteen hours of lecture and 36 hours of field time. This course acquaints the student with the basic harvesting methods and techniques, with emphasis on the Northeast, along with the knowledge of how and where harvesting fits in with other forest uses. Students gain technical competence in timber sale contract administration and basic timber appraising. Spring.

FTC 217. Forest Management ....(3-1/2)
Thirty-seven hours of lecture and 68 hours of lab and field work blocked with silviculture. Coverage of the common problems met in organizing a forest property to approach the goals of ownership. Study and practice in techniques of growth measurement and the gathering and use of forest records in general. Review actual examples and case studies of forest management and production activities. Summary application of pertinent information from many other courses in a work plan involving management decisions for an assigned forest property. Spring.
Prerequisite: FTC 206.

FTC 218. Forest Recreation ....(1-1/2)
Fourteen hours of lecture and 32 hours of field/laboratory time. This course acquaints the student with the forest recreational resource, its present and future needs. Principles of recreational development and management are discussed with special emphasis placed on the technical aspects. Spring.

FTC 219. Elements of Wildlife Ecology ....(1-1/2)
Twenty-four hours of lecture and four hours of field time. A study of the principles of wildlife ecology with fundamentals related to the actions of the preservationist, conservationist, and particularly those of the forest manager. Spring.

FTC 221. Soil/Water Measurements and Control ....(1-1/2)
Fourteen hours of lecture and 28 hours of laboratory and field time. A basic introduction to precipitation and streamflow measurements taken at weather stations, snow courses, streamgaging stations, and other sample points. Includes field and lab measure-

ments for determining physical properties of soils related to land management. Discusses forest management practices commonly used to control erosion and water quality. Spring.
Prerequisite: FTC 206 Forest Ecology.

FTC 223. Graphics ....(1)
Sixteen hours of lecture. An introduction to lettering and drafting with emphasis on the skills needed by the forest or surveying technician. Individual skill development is achieved through several projects. The concept behind each project is explained in handout material and lecture, and each student is then expected to complete the project on his/her own time. Freehand and mechanical lettering plates are produced in addition to precision and map drawings. Fall.

FTC 226. Forest Pathology ....(1)
Twenty hours of lecture and 16 hours of laboratory/field time. A study of forest and shade tree diseases, disease identification, disease classification, economic and ecological impacts of diseases, and the role of diseases in the forest community. Fall.

FTC 227. Fire Management ....(2)
Twenty-seven hours of lecture and 16 hours of laboratory/field time. The basic principles of fire ecology, forest fire behavior, fire danger and fire danger rating, forest fire prevention and control, and prescribed burning are covered. Fire behavior and fire danger rating are calculated using computers. Handtool fire suppression techniques are practiced and demonstrated. Spring.

FTC 228. Structure and Growth of Trees ....(1-1/2)
Seventeen hours of lecture and 12 hours of laboratory. A study of the various tissues of forest trees and how their growth and development are affected by internal and external factors. Differences in stem structures of some of the more important commercial tree species of the U.S. are studied in the laboratory and these differences are related to the commercial uses of these species. Spring.
Prerequisite: An introductory course in general botany or biology.

FTC 229. Silviculture II.............................(2)
Twenty-six hours of lecture and 28 hours of field and laboratory. Continuation of FTC 211 dealing mainly with the handling of the more complex hardwood and mixed stands common to the Northeast. Special coverages will be offered on current practices of regional importance beyond the Northeast where graduates are likely to be employed. Spring.

FTC 230. Plane Surveying III ....(2)
Twenty-six hours of lecture and 28 hours of field time. A continuation of FTC 202 and FTC 203 with emphasis on small crew projects using the theodolite. Advanced field techniques are discussed and practiced, such as the determination of the true-meridian by the method of direct solar observation, layout of highway curves and simple triangulation procedures. Each topic is developed in detail in the classroom before each field project is completed. Spring.
Prerequisites: FTC 202 and FTC 203.

FTC 298. Independent Study in Forest Technology ....(1-6)
Independent study in forest technology to apply, enhance, or supplement forest technology or related natural resource education. Objectives and scope of the project are negotiated in a learning contract between the student and instructor(s), with course admission based on permission of the instructor(s). Limited to those who have attended the complete regular SFT program, or those who have graduated from another forest technology program or a related natural resource program, or to students enrolled in any ESF program other than than of the SFT. A maximum of 6 credit hours may be taken by any student in total. Semesters as arranged. Fall, Spring, or Summer.

LIB - LIBRARY (COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY COURSE)

LIB 300. Library Research ....(1)
Fifteen hours of class time per semester (usually the first five weeks). Introduction for students at all levels to basic library material and the research process leading to preparation of a bibliography. Fall and Spring.

LSA—LANDSCAPE ARCHITECTURE

(See also courses listed under EIN and CMN.)

LSA 320. Introduction to Landscape Architecture and Planning.................................(3)
Three hours of lecture. The course presents an overview of the professions of landscape architecture and planning. It surveys the historic and contemporary situations of environmental design and planning. The course introduces the socio-cultural and natural factors which influence the form and condition of the physical environment. It will introduce issues, personality, and projects. Fall.

LSA 326. Landscape Architecture Design Studio I..........(3)
Six hours of studio and one hour of lecture. The first in a sequence of studios focusing on the concepts, skills, and methods of design. This course introduces students to the basic vocabulary, concepts, and principles of design; the application and operation of these in the physical environment, development of three-dimensional spatial concepts. The requirements for this course include readings, examinations, field trips, design exercises, and projects. (Student field trip expense $125-$150.) Fall.
Prerequisite: Permission of the instructor.

LSA 327. Landscape Design Studio II ....(3)
One hour of lecture and six hours of studio. The second in a sequence of studios focusing on the concepts, skills, and methods of design. This course continues the development of design abilities through study of the interrelationship between the requirements of a design established in a program, the visual character of the site and the development of a designed result. The development of spatial concepts which meet principles of composition organization and a given set of requirements. The requirements for this course include readings, examinations, field trips, design exercises, and projects. (Student field trip expense $125-$150.) Spring.
Prerequisites: LSA 326, with a minimum grade of C, and CMN 382.

LSA 330. Site Research and Analysis ....(3)
One hour of lecture and three hours of studio per week. This course will require those enrolled to apply principles of natural resources and processes to assess the land use and development potentials and limitation of a site. The principles will include landforms, soils, hydrology, climate, energy, and plant, animal and human ecology. A variety of manual and computer techniques for data collection, analysis and synthesis of natural systems information will be explored. The course will concentrate on the comparison of synthesis techniques and their implications for land use and design decisionmaking. Occasional local field trips will be utilized. Spring.
Prerequisite: LSA 411 or permission of the instructor.

LSA 411. Natural Processes in Planning and Design ....(3)
Two hours and forty minutes of lecture per week. An overview of basic principles and processes of physical and biological landscape systems with respect to their roles in landscape design and planning. Emphasizes landform, soil, slope, hydrology, climate, energy, and general ecological issues as common elements influencing landscape design and the land use decisionmaking process. Sources and uses of environmental data are discussed. Fall.

LSA 422. Landscape Design Studio III............(4)
Twelve hours of studio. This course is a continuation of skill development, theory, and strategies as they relate to design issues and process. Emphasis is placed on in-depth investiga-

tion on projects of a direct scale illustrating form derivation and the man-made and natural form. Occasional field trips to illustrate various design solution. Fall.

Prerequisites: LSA 327, with a minimum grade of C, and LSA 330.

LSA 423. Landscape Design Studio IV ....(4)
Twelve hours of studio. This course emphasizes skill development, theory, and strategy as they relate to large-scale site design situations. Continues prior courses' emphasis on design process and form manipulation. Occasional field trips to illustrate and inspect design form. Spring.

Prerequisite: LSA 422, with a minimum grade of C.

LSA 425. Orientation for Experiential Studio ....(2)
Three hours of lecture and recitation. Investigation and documentation of an area of specialty, discussion, readings, and research. Fall and Spring.

Prerequisite: Permission of the instructor.

LSA 433. Plant Materials ....(2)
Three hours of lecture and field work for first one-third of semester. Two hours of lecture for second one-third of semester. This course concentrates on woody plant materials used in landscape architecture, the ecological relationships of plants, ornamental plant materials use and identification, plant culture propagation, transplanting, planting plans and specifications. Fall.

Prerequisite: Permission of the instructor.

LSA 434. Design Materials ....(1)
Three hours of lecture for last one-third of a semester. An introduction to wood, concrete, masonry, asphalt, stone, and synthetic materials intended to provide students with an understanding of the basic visual, structural, and maintenance principles of each, in order to both use the materials in design and prepare written specifications. Fall.

LSA 442. Site Grading ....(2)
Two hours of lecture and three hours of studio during first two-thirds of semester. Lectures, projects, and assigned readings. The study of grading as the primary means of landform modification in landscape architectural design. Primary emphasis will be given to principles of grading, including contour manipulation, sections, profiles, and computations. Concepts of establishing acceptable slopes and positive surface drainage will be introduced. Enrollment limited to BLA or MLA students. Fall.

Prerequisite: LSA 330, Site Research and Analysis.

LSA 443. Site Drainage Systems ....(1)
Three hours of lecture for last one-third of semester. Lectures, projects, and assigned readings. Provides a basis for the design of drainage systems. Coverage includes concepts relevant to understanding precipitation, methods of run-off quantification, open channel flow, systematic pipe network analysis. Enrollment limited to BLA or MLA students. Fall.

Prerequisite: LSA 330, Site Research and Analysis.

LSA 444. Vehicular Circulation Design ....(1)
Three hours of lecture for first one-third of semester. Lectures, projects, and assigned readings. Must be taken concurrently with LSA 423. Introduces the circular geometry of horizontal curves and the parabolic geometry of vertical curves, curve coordination based on safety and aesthetic relationships, road grading. Enrollment limited to BLA or MLA students. Spring.

Prerequisites: Computer programming and surveying.

LSA 445. Elements of Structures ....(1)
Three hours of lecture during the second one-third of the semester. Lectures, projects, and examinations. An introduction to the concepts of assembling engineering materials into structure. All common building systems will be surveyed and emphasis will be placed on fundamentals rather than on detailed mathematical design procedures.

Prerequisite: Non-Faculty of Landscape Architecture students by permission of the instructor. Not open to engineering majors. Spring.

LSA 451. Comprehensive Land Planning ....(3)
Three hours of lecture per week. Introduction to the planning process including survey and analysis techniques, the comprehensive plan, political context, and land use controls. Selected functional planning areas such as land use, environmental, growth management, regional planning, and economic development planning. Legal and historical basis.

Prerequisite: LSA 411 or permission of the instructor.

LSA 453. Community Land Planning Workshop .(4)
Land use and environmentally related planning issues explored through a case study including surveys, analyses, plan preparation, development of implementation strategies, and report preparation.

Prerequisites: LSA 411 and 451 or permission of the instructor.

LSA 455. Professional Practice in Landscape Architecture . (2)
Two hours of lecture. This course examines the historic and contemporary modes of landscape architectural practice including practice types, ethics, operations, and client systems. Particular emphasis is given to the projected trends of professional practice and with impact on future roles for the landscape architect. Professional development is reviewed as it relates to internship, licensing, and continuing education. Occasional field trips will be utilized. Spring.

Prerequisites: Senior status in landscape architecture or permission of the instructor.

LSA 495. Selected Readings in Environmental Studies ... (1-3)
Exploration of selected readings in depth with individual independent study upon a plan submitted by the student and related to credit hours assigned. Upon approval of the instructor, the student may systematically investigate some subject area encountered in regularly scheduled courses or may initiate research on a variety of subject areas of determined relevance. Fall and Spring.

Prerequisite: Permission of the instructor.

LSA 496. Special Topics in Landscape Architecture......(1-3)
One to three hours of class meetings. Special topics of current interest to undergraduate students in landscape architecture and related fields. A detailed course subject description will be presented as a topic areas is identified and developed. Fall and Spring.

Prerequisite: Permission of the instructor.

LSA 498. Introductory Research Problem ....(1-3)
Guided study of a selection of problems relating to landscape architecture and environmental design. Emphasis on study procedure and methods employed. Enrollment at periodic intervals throughout the semester. Fall, Spring, and Summer.

Prerequisite: Permission of the instructor.

LSA 522. Landscape Design Studio VI ....(4)
Twelve hours of studio. Studio problems, research, drafting and field trips. Concentration on complex urban problems. Concern for social and psychological considerations of the individual and large groups of people, their interaction and resultant forms of the environment. Spring.

Prerequisite: Permission of the instructor.

LSA 524. Experiential Landscape Studio Design ....(16)
Forty-eight hours per week. The articulation of the study proposal established in LSA 425, as approved by faculty, through research, readings, field study with graphic and written documentation, and group discussion. Academic study in an off-campus location in an area of landscape architectural significance, as described and delineated in a student-prepared proposal approved by the faculty. Fall or Spring.

Prerequisites: LSA 425 and LSA 423, with a minimum grade of C.

LSA 525. Landscape Design Studio VI .... (4)
Twelve hours of studio. Investigation of a problem in landscape architecture as proposed by the student and conducted in conjunction with faculty advisor. Spring.
Prerequisite: Permission of the instructor.

LSA 527. Landscape Design Studio VI .... (4)
Twelve hours of studio. Studio problems, research, reports, and field trips. Concentration on regional landscape problems, the techniques of their analysis and derivation of their significance to the practice of landscape design. Spring.
Prerequisite: Permission of the instructor.

LSA 533. Plant Materials .... (2)
Field trips and discussion. Ornamental woody plant identification. Observation and sketches of outstanding examples of planting design. Two weeks. Summer.
Prerequisite: Permission of the instructor.

LSA 545. Professional Practice Studio .... (3)
Six hours of studio, one hour of recitation per week. Studio problems, research, discussion and recitation sessions on the processes and methods of office practice. Emphasis on all aspects of site development. Spring.
Prerequisite: Permission of the instructor.

LSA 595. Selected Readings in Landscape Architecture . (1-3)
Exploration of selected readings in depth with individual independent study upon a plan submitted by the student and related to credit hours assigned. Upon approval of the instructor, the student may systematically investigate some subject area encountered in regularly scheduled courses or may initiate research on a variety of subject areas of determined relevance. Fall or Spring.
Prerequisite: Fifth-year status or permission of the instructor.

LSA 596. Special Topics in Landscape Architecture ...... (1-3)
Experimental or special coursework in landscape architecture for graduate and undergraduate students. Subject matter and method of presentation vary from semester to semester. Fall and Spring.
Prerequisite: Permission of the instructor.

LSA 598. Research Problem .... (1-3)
Independent study of selected areas of environmental interest. Emphasis on a self-disciplined study, development of procedures and techniques to be employed in environmental design and planning. Engagement with specific sites and problems as proposed for study by individual communities. Enrollment at periodic intervals throughout the semester. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor.

LSA 600. Design Studio I .... (4)
Nine hours of studio and one hour of lecture/discussion per week. The first in a sequence of studios focusing on the concepts, skills, and methods of design. This course introduces students to the basic vocabulary of theoretical design principles, to the application and operation of these in the physical environment, and to the development of three-dimensional spatial concepts in community scale patterns. The requirements for the coarse include readings, examinations, field trips, design exercises, and projects. Fall.
Prerequisite: MLA status or permission of the instructor.

LSA 601. Design Studio II .... (4)
Five hours of studio and one hour of lecture per week. The second in a sequence of studios applying the concepts, skills, and methods of design in a critical analysis of various natural and human systems in community scale environments. Concentration is on the evaluation of options concerning a variety of land use activities, with special emphasis on landscape analysis and the functional and spatial quality of built environments. The requirements for this course include readings, examinations, field trips, design exercises, and projects. Spring.
Prerequisites: MLA status and LSA 600, CMN 552, or permission of the instructor.

LSA 611. Natural Factors Analysis .... (3)
Two hours and forty minutes of lecture and one hour of discussion per week. This course addresses basic principles and processes of physical landscape systems with respect to their roles in landscape design and planning. Sources and uses of environmental data are discussed and illustrated. An emphasis is placed on landform, soil, slope, hydrology, climate, and general ecological issues as common elements influencing landscape design and the land use decisionmaking process. Fall.
Prerequisite: MLA status or consent of the instructor.

LSA 615. Site Construction Grading, Drainage and Road Layout .... (3)
One hour of lecture and six hours of studio per week. This course provides an introduction to important site construction basics, including landscape grading and landform manipulation to achieve appropriate slopes for use and positive surface drainage, principles of cut/fill analysis and subsurface drainage, horizontal and vertical alignment for road design, storm water management, and soil erosion control. Appropriate analysis methods and technologies will be employed through studio projects and exercises. Spring.
Prerequisite: MLA status, concurrent enrollment in LSA 601 or consent of the instructor.

LSA 620. Design Studio III—Advance Site Design .... (4)
One hour of lecture and nine hours of studio per week. This course is the third in a sequence of landscape architectural design studios. It focuses on advanced issues in site design and on the integration of project programming and design development into the design process. Concentrations include detailed designing for site layout, grading, storm water management, interior and exterior planting, site furnishing, and site lighting. Design exploration and project communication techniques are pursued such as CAD, reprographics, and computer-based visual simulation. Course requirements include readings, field trips, exercises, and design projects. Fall.
Prerequisites: MLA status, LSA 601, LSA 611, LSA 615, or consent of the instructor.

LSA 621. Design Studio IV - Community Design and Planning .... (4)
Nine hours of studio and one-hour of lecture/discussion per week. Design studio problems addressing principles and practice of community design, the structure and language of human settlements, community design process, natural systems and community design, and an introduction to the history, traditions and literature of the field. Spring.
Prerequisite: LSA 620 or consent of the instructor.

LSA 640. Research Methodology .... (3)
Three hours of lecture and discussion per week. This course focuses on the application of scholarly and scientific methodology to the activity of intellectual inquiry. The purpose is to enable students to identify researchable questions and introduce the methodology necessary to answer these questions in an unambiguous and objective manner. The course addresses issues of theory, research organization, experimental design, sampling theory, data manipulation, and communication with respect to proposals, projects, theses, and technical papers. Spring.
Prerequisite: Graduate standing or consent of the instructor.

LSA 650. Behavioral Factors of Community Design .... (3)
Three hours of lecture and discussion. An introduction to the contribution of the behavioral sciences to community design and planning is provided. Readings and discussions concern both theoretical and methodological aspects. Case studies are used to illustrate a variety of current behavioral science applications. Course assignments to familiarize the student with basic behavioral science methods including questionnaires, observations, and interviews. A final project provides an opportunity to synthesize course materials. Fall or Spring.
Prerequisite: MLA status or permission of the instructor.

LSA 652. Community Development and Planning Process (3)
Three hours of lecture per week. This course introduces planning and community development as connected, interdependent processes. Community dynamics, the participants in the planning and development processes, theories, principles and practices, and the role of design, will be explored. Lectures, seminars, guest speakers, research projects, readings, and discussion will be used to engage the course material. Fall.

LSA 653. Visual Landscape Analysis..........(2-3)
Three hours of lecture and discussion weekly during the first three quarters of the semester will cover aspects of landscape perception; introduction to methods of visual landscape inventory and evaluation, visibility determination, psychometric assessment, and visual impact assessment; and visual resource management strategies. Problems and exams will be required. Optional third credit entails four hours weekly of laboratory or field projects applying analysis methods and techniques during last quarter of semester.

LSA 654. Ecology in Landscape Design and Planning.......(3)
Three hours of lecture and discussion per week, with some Saturday field trips required. This course addresses methods of describing vegetative patterns in the landscape, emphasizing the processes that produce these patterns and the interactions that cause them to change. Familiarization with natural and cultural plant communities and the species that dominate their composition. The purpose is to identify the major biotic components that shape the ecological landscape, and relate them to pragmatic issues of land use, vegetation management, and landscape design. Fall.
Prerequisites: LSA 433, or LSA 533, or EFB 320, or EFB 578, or a dendrology course, or consent of the instructor.

LSA 655. Professional Practice for MLAs ....(4)
Two hours of lecture and six hours of studio per week. This course provides an overview of contemporary professional practice in public and private sectors, including steps in project implementation, familiarization with project management, marketing techniques, professional standards/conduct/registration, liability and ethics. Students will complete a set of typical construction documents in this course. Spring.
Prerequisite: MLA status or consent of the instructor.

LSA 656. Visual Landscape Simulation ....(3)
Two hours of lecture and discussion and three hours of workshop per week. An introduction to the theory and principles of creating visual landscape simulations. Students will develop skill in digital photography techniques and apply them to an assigned project. Fall or Spring.

LSA 671. History of Landscape Architecture................(3)
Three hours of lecture-seminar. Regular use of slides and other projected lecture material; assigned texts as a basis for lecture; supplemental readings, assigned and individually researched; class discussion from readings and lecture; and student presentations and term paper. Historical study and style analysis of Western man's efforts to design his environment and his changing attitudes and relationships to environment. Also, non-Western coverage where significant or influential on Western man. Study of historical personalities as well as periods that are of environmental concern up into the modern periods. Fall.
Prerequisite: MLA standing or permission of the instructor.

LSA 696. Special Topics in Landscape Architecture......(1-3)
Experimental or special coursework in landscape architecture for graduate and undergraduate students. Subject matter and method of presentation vary from semester to semester. Fall and Spring.
Prerequisite: Permission of the instructor.

LSA 697. Topics and Issues of Landscape Architecture (1)
Two hours of lecture and discussion every other week. Topics for discussion are selected to acquaint the entering graduate student with a generalized view and current issues facing landscape architects. Students are required to audit LSA 320 concurrently. Fall.
Prerequisite: MLA students or permission of the instructor.

LSA 699. Landscape Architecture Internship ....(1-12)
Internships provide students with a supervised field experience to apply and extend their academic abilities in a professional working environment. Enrollment is possible at various times during the semester. Fall, Spring, and Summer.
Prerequisite: Fast Track BLA/MLA status and written approval of an internship contract by major professor, curriculum director, and field supervisor.

LSA 700. Design Studio V- Integrative Studio (4)
One hour of lecture and nine hours of studio per week. This studio requires the integration of design/planning processes, research methods and information, and technical skills through focus on large-scale, community-based or multicommunity-based projects. Studio work will require individual and team work, as well as consideration of multidisciplinary contributions and interdisciplinary work. This studio is the final studio for all MLA students. Fall.
Prerequisites: LSA 600/601, LSA 620/621 or permission of the instructors.

LSA 752. Urban and Regional System Dynamics ....(3)
Lectures and workshop. The major concerns of this course are application of system dynamics; basic principles of system dynamics; and system dynamics modeling. This method is investigated as a useful tool in modeling many landscape architectural and planning problems. No prior computer experience is necessary. Spring.
Prerequisite: Permission of the instructor.

LSA 796. Special Topics in Landscape Architecture......(1-3)
One to three hours of class meetings. Special topics of current interest to graduate students in landscape architecture and related fields. A detailed course subject description will be presented as a topic area is identified and developed. Fall and Spring.
Prerequisite: Permission of the instructor.

LSA 798. Research Problem
(Credit hours to be arranged according to nature of problem)
Special study of assigned problems relating to landscape architecture or planning, with emphasis on critical thinking. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor.

LSA 799. Thesis/Project (Internship) Proposal Development
...(1)
One hour of lecture/workshop per week. During this course, a student will prepare a proposal for a thesis/project in the MLA program. Spring or Fall.
Prerequisite: LSA 640 or permission of the instructor.

LSA 898. Professional Experience ....(1-12)
A supervised external professional work experience which satisfies Option 2 of the master's study integration requirement. Graded on an "P/F" basis. Fall, Spring, and Summer.
Prerequisite: Formation of committee, approval of proposed experience by committee, and the sponsor of the professional experience.

LSA 899. Master's Thesis Research (Credit hours to be arranged)
Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

PSE—PAPER SCIENCE AND ENGINEERING

PSE 300. Introduction to Papermaking .... (3)
Three hours of lecture. Historical and commercial consideration of the paper industry. Technology of papermaking with emphasis on stock furnish, stock preparation and paper machine operation. Introductory discussions of papermaking materials and formation and reactions of a fibrous web. Fall.

PSE 301. Pulp and Paper Processes .... (3)
Three hours of lecture. Technological consideration of pulping and bleaching of woody raw material. Includes consideration of wood procurement and preparation, pulping and bleaching processes, recovery of secondary fibers, pollution abatement and other ancillary operations. Spring.
Prerequisites: FCH 572, PSE 300 (or concurrent).

PSE 302. Pulp and Paper Processes Laboratory .. .. (1)
One three-hour laboratory. Study and practice in the techniques of laboratory procedures normally encountered in the pulp and paper industry. Laboratory exercises selecting and using standard testing methods. Field trips to observe commercial equipment of the pulp and paper industry. Spring.
Prerequisite: PSE 301 (or concurrent).

PSE 304. Mill Experience .... (2)
Twelve weeks full-time pulp or paper mill employment approved by the faculty between the junior and senior years. The student must submit a comprehensive report to fulfill this requirement. Summer.

PSE 361. Engineering Thermodynamics .... (3)
Principles of classical thermodynamics applied to engineering practice. First and second laws; heat effects; property functions and their correlation; physical and chemical equilibria; solutions and mixtures; power and refrigeration cycles. Thermodynamic analysis of processes and systems via case studies and computer simulation.
Prerequisites: Physics, calculus, PSE 370 and FCH 360 or equivalent.

PSE 370. Principles of Mass and Energy Balance .... (3)
Three hours of lecture. Conservation of mass and energy applied to steady-state and dynamic process units and systems. Problem analysis and solution; computational techniques. Thermodynamic data and their use; real vs. perfect gases; steam properties; psychrometry. Fall.
Prerequisites: Calculus, physics, and FCH 360 (or concurrent).

PSE 371. Fluid Mechanics .... (3)
Three hours of lecture and/or demonstrations. The study of momentum transfer. Steady and unsteady flow of liquids and gases in pipelines, ducts, open channels, and porous media. Movement of particles in fluid media. Newtonian and non-Newtonian flow and flow of suspensions. Filtration, sedimentation, centrifugation, agitation and mixing. Characteristics and selection of pumps, blowers, agitators and other equipment. Flow measurement and flow system design with economic considerations. Fall.
Prerequisites: College level physics and chemistry, calculus.

PSE 372. Heat Transfer .... (3)
Two hours of lecture and/or demonstration. The study of heat transfer including conduction, convection, radiation and their applications in industry. Heater and heat exchanger design and selection, and industrial evaporation. Spring.
Prerequisites: PSE 370 and 371 or equivalent.

PSE 456. Management in the Paper Industry Lecture Format with Seminars .... (3)
Provides the student with interactive contact with active executives in the paper and allied industries. The student will develop and present studies of business cases in discussion forum to the class. An understanding of how general managers operate to manage an entire organization will be presented by visiting experts, class participation, group presentations, written papers, and examinations.

PSE 461. Pulping Technology .... (3)
One hour of lecture and six hours of laboratory. Discussion of pulping and bleaching processes: effect of chemical and physical variables on the wood components and pulp properties; chemistry involved. Experiments in pulping and bleaching, and pulp evaluation. Fall.
Prerequisites: PSE 301, FCH 360 and FCH 361 or equivalent.
Note: A student may not enroll in or receive credit for both PSE 461 and ERE 671.

PSE 465. Paper Properties .... (4)
Three hours of lecture, three hours of laboratory and discussion. Evaluation and study of the physical, optical, and chemical properties of paper and the interrelationships existing between paper manufacturing methods, papermaking additives, test results and the ultimate properties desired in the finished paper. Fall.
Prerequisites: PSE 300 and PSE 301.
Note: A student may not enroll in or receive credit for both PSE 465 and ERE 677.

PSE 466. Paper Coating and Converting .... (2)
Two hours of lecture. Evaluation and study of various coating materials and processes used by the paper industry. Introduction to polymers and their use in converting operations. Study of materials and equipment used in converting operations, fundamentals and parameters which control their use, effects on final properties of papers. Spring.
Prerequisite: PSE 465.
Note: A student may not enroll in or receive credit for both PSE 466 and ERE 678.

PSE 467. Papermaking Wetend Chemistry .... (3)
Provides the student with the fundamental principles of Colloid and Surface Chemistry as they relate to the interaction of papermaking materials and chemical additives in the wetend of a papermachine system. The topics of retention of fine solids and dewatering are addressed in detail. Application of the various topics presented during the course are made during a pilot papermachine trial.
Prerequisite: Senior standing in PSE program or consent of the instructor.

PSE 468. Papermaking Processes .... (3)
Two hours of lecture and three hours of laboratory. Study of the papermaking process, featuring operation of the pilot paper machine. Emphasis is on the fundamentals of stock preparation, paper machine operation, evaluation of the finished product and the collection and analysis of data to develop material and energy balance. Results of each paper machine run are evaluated in seminar-type discussions. Spring.
Prerequisites: PSE 461 and PSE 465.

PSE 473. Mass Transfer .... (3)
Three hours of lecture. The study of mass transfer, humidification, air conditioning, drying, gas absorption, distillation, leaching, washing, and extraction. Fall.
Prerequisites: PSE 370, 371, and 372 or equivalent.

PSE 477. Process Control .... (3)
Two hours lecture and discussion and one to three hours computer lab or field trip per week. Presents an introduction to the principles of process control. Linear analysis, LaPlace transforms, and nonlinear simulation are presented and applied to feedback, feedforward, cascade and adaptive control. Examples of process simulation, accuracy and stability of control are drawn from paper industry processes.
Prerequisite: Differential equations or consent of the instructor. Senior standing desirable.

PSE 480. Process and Plant Design I: Analysis ....(3)
Engineering analysis of modern plant practice in the pulp and paper, chemical and related industries. Operating costs, profitability criteria, optimization techniques and evaluation of alternatives. Modeling and computer simulation of process units and systems; use of typical software. Design exercises and case studies. Spring.

PSE 481. Process and Plant Design II: Synthesis ....(3)
Design-project procedure; data sources and development. Application of simulation and computer-aided design to process synthesis and plant layout. Formulation and solution of original design problems. Fall.
Prerequisite: PSE 480 or permission of the instructor.

PSE 491. Paper Science and Engineering Project I ....(1)
Student makes a systematic survey of all available literature on the problem assigned him and incorporates it in a formal, typewritten report. An essential part of this report is a detailed outline of a research project which the student may undertake during the next semester (PSE 492). Fall.
Prerequisites: PSE 300 and PSE 301.

PSE 492. Paper Science and Engineering Project II ....(3)
The analysis of a problem, the synthesis of a solution and the basic design of the facilities needed to solve a problem. Laboratory research, field work, and consulting as needed in addition to the literature survey completed in PSE 491. Progress reports and a final report and seminar-style presentation. Spring.
Prerequisite: PSE 491.

PSE 496. Special Topics ....(1-3)
Lectures, conferences, and discussions. Specialized topics in chemistry, chemical engineering, and physics as well as topics pertaining to management as related to the pulp, paper, paperboard, and allied industries. Fall and Spring.

PSE 498. Research Problem ....(1-4)
The student is assigned a research problem in pulping, bleaching, refining, additives, quality control of paper or paper products, or chemical engineering. The student must make a systematic survey of available literature on the assigned problem. Emphasis is on application of correct research technique rather than on the results of commercial importance. The information obtained from the literature survey, along with the data developed as a result of the investigation, is to be presented s a technical report. Fall, Spring, and Summer.
Prerequisites: PSE 461 and PSE 465.

WPE—WOOD PRODUCTS ENGINEERING

WPE 300. Properties of Wood for Designers...(2)
Two hours of lecture. An introduction to the basic structure and properties of wood for the designer. Discussion of the effects of wood structure and properties on practical woodworking techniques. Fall.

WPE 322. Mechanical Processing ....(3)
Two hours of lecture and three hours of laboratory. Primary log reduction methods and industry practices. Lumber grading. Wood cutting principles. Machining practice in secondary wood-using industries. Experience in the operation of certain primary and secondary machining equipment.

WPE 326. Fluid Treatments.................................(2)
Two hours of lecture. An introduction to wood-moisture relationships, wood permeability and pressure treatments, thermal conductivity, water-vapor movement, and drying and fire retardancy. The flow of fluids, heat and water vapor are treated as analogous phenomena and are related to the cellular structure of wood. Unsteady-state flow of gases, heat and water vapor are introduced. Spring.

WPE 327. Fluid Treatments Laboratory ....(1)
Three hours of laboratory. Laboratory studies in relative humidity measurement, wood-moisture relationships, the relationship between permeability and treatability, wood-preservative treatments, wood drying and flame testing. Spring.
Prerequisite: WPE 326 (or concurrent).

WPE 330. Building Codes and Zoning Practices (3)
This course shall introduce the student to the New York State Building Code and local fire, zoning and administrative ordinances pertaining to the construction and maintenance of buildings. The student shall be introduced to building system classification; systems components including mechanical, electrical, fire, and structural elements; and the need for safety regulations governing construction and occupancy of buildings. Emphasis shall be placed on construction plans review and code enforcement administration. Fall or Spring.

WPE 332. Mechanical and Electrical Equipment (3)
This course shall introduce the basic concepts of mechanical systems design and construction for residential and commercial buildings. Systems design and equipment selection are performed for heating, cooling, plumbing, sanitation, electrical, lighting, and acoustics. Emphasis is placed on the use of the New York State Building Code, the New York State Energy Conservation Code, the National Electrical Code, and the American Society of Heating, Refrigeration and Air Conditioning Engineering Manual. Fall or Spring.

WPE 335. Cost Engineering ....(3)
Methods and procedures for monitoring, analyzing, forecasting, and controlling construction project costs. Project cost control systems. Productivity. Comparative cost evaluation of alternatives in construction methods and equipment. Life-cycle costing. Capital, operating, and equipment costs. Inflation and cost escalation. Cost and bidding models. Linear programming applications. Fall.

WPE 342. Light Construction ....(3)
Three hours of lecture. Elements of structural design, light-frame construction, blueprint reading, and estimating. Fall.

WPE 343. Construction Estimating ....(3)
Introduction to construction estimating by the quantity takeoff method. Residential and commercial estimates shall be performed by the student using Walker and Means references. The student shall be introduced to the use of spreadsheet and estimating software for construction estimate preparation. Fall or Spring.
Prerequisite: WPE 342.

WPE 350. Construction Methods and Equipment ....(3)
Major operations comprising construction projects: excavation and fill, concrete, structural steel, welding, masonry, and bituminous operations. Calculating equipment production, planning the project, and deciphering the contract drawings and specifications. Fall.
Prerequisite: Statics (ERE 221; or equivalent).

WPE 386. Structure and Properties of Wood...(2)
Two hours of lecture. Structure of wood in relation to defects, properties and uses. The variability of wood. Spring.

WPE 387. Wood Structure and Properties ....(3)
Three hours of lecture. Structure of wood and its relation to physical properties and uses. The normal variability of wood, abnormal growth, defects, deterioration of wood and their influence on properties and uses. Fall.

WPE 388. Wood and Fiber Identification Laboratory ....(2)
Six hours of laboratory. Wood and papermaking fiber identification using both gross and microscopic features. Fall.
Prerequisite: WPE 387 to be taken concurrently or previously.

WPE 389. Wood Identification Laboratory ......(1)
Three hours of laboratory. Identification of principal commercial timbers of United States on gross characteristics. Spring.
Prerequisite: WPE 387.

WPE 390. Fiber Identification Laboratory ......(1)
Three hours of laboratory. Identification of woody and nonwoody papermaking fibers. Spring.
Prerequisite: WPE 387.

WPE 399. Field Trip ....(1)
One week immediately following the spring semester supervised study and reporting of representative wood products industries and construction sites. Required of all students in WPE. Estimated individual expenses are about $350 while on the trip.

WPE 400. Introduction to Forest Products .....(3)
Three hours of lecture. Characteristics of the products of the forest tree and manufacture of wood products. Spring.

WPE 401. Creative Approaches to Management(3)
Three hours of lecture and recitation with a workshop/seminar emphasis. Provides practical guidelines for dealing effectively with modern managerial problems that require new thinking. This course uses relevant, real-life examples, practical applications, and develops creative approaches. It is designed for individuals who intend to or are engaged in managing people and activities in achieving both organizational and personal goals. Spring.

WPE 404. Timber Design Project ....(3)
Lectures, discussion, and laboratory. Mechanical testing of wood, development of working stresses, design of a model structure, and construction and testing of the structure. Spring.
Prerequisites: Mechanics of materials and senior standing or permission of the instructor (ERE 362, CIE 325, or equivalent).

WPE 413. Computer-Aided Senior Project......(3)
Open-ended real life design projects with microcomputer aids. Systems approach is emphasized. Project requirements, system selection,approximate design, value engineering, and final design are among design aspects considered. Analytical and model analysis. Spring.
Prerequisite: FEG 410 or equivalent.

WPE 414. Computer Applications in Engineering (3)
Microcomputer applications in a broad spectrum of selected topics in engineering sciences and practice. Hands-on experience is emphasized. Coursework is directed towards solving real life engineering problems. Software are provided and used. No computer programming or skills are required. Spring.
Prerequisite: FEG 410 or equivalent.

WPE 420. Adhesives, Sealants, and Coatings..(3)
Two hours of lecture and three hours of laboratory. An introduction to adhesives, sealants, and coatings used in the wood products and building construction industries. All three types of materials, based upon polymers, will be evaluated in terms of their properties and respective technologies. Emphasis will be placed on knowing how to apply this knowledge to understand current practice and problem solving. Laboratory demonstrations to identify materials, methods of application, and methods of evaluating these materials. Fall.
Prerequisite: Junior standing.

WPE 422. Composite Material ....(3)
Two hours of lecture and three hours of laboratory. Manufacturing methods, physical and mechanical properties, and major uses of each of the following products will be examineddecorative plywood, con-truction and industrial plywood, particleboards, waferboards, fiberboards, laminated beams, laminated-veneer lumber, wood polymer composites, and overlays. Laboratory exercises will be patterned after ASTM standard tests to evaluate the physical and mechanical properties of these materials with written reports to be submitted by each student. Spring.
Prerequisites: WPE 420. Concurrent or prior registration in ERE 362.

WPE 453: Construction Planning and Scheduling ....(3)
Methods and concepts for planning and scheduling of operations and resources on construction projects. Topics include Gantt charts, progress curves, critical path methods, and project networking techniques. Microcomputer applications. Fall.

WPE 454. Construction Project Management...(3)
Techniques of managing a construction project: Estimating, CPM scheduling, field administration, quality control, contract law, labor relations, safety. Spring.
Prerequisite: WPE 350.

WPE 455. Construction Contracts and Specifications.......(3)
Introduction of the types of contracts used in the construction industry. Analysis of the contractor's, designer's, and owner's duties and obligations as determined by the construction contract documents. Study of concepts, language, formats, and procedures for project manual organization practice and the general conditions of the contract for construction. Spring.

WPE 497. Senior Seminar for Wood Products Engineering Majors ....(2)
Discussion and assigned reports in current problems and new developments in Wood Products Engineering. Fall.

WPE 498. Research or Design Problem ....(1-3)
Conferences, library, laboratory and/or field research on a specific problem in Wood Products Engineering. Typewritten report (original and one copy) required. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor and advisor.

State University of New York

STATE UNIVERSITY OF NEW YORK

State University's 64 geographically dispersed campuses bring educational opportunity within commuting distance of virtually all New York citizens and comprise the nation's largest, centrally managed system of public higher education.

When founded in 1948, the University consolidated 29 State-operated, but unaffiliated, institutions. In response to need, the University has grown to a point where its impact is felt educationally, culturally, and economically the length and breadth of the state.

Nearly 379,000 students are pursuing traditional study in classrooms or are working at home, at their own pace, through such innovative institutions as Empire State College, whose students follow individualized and often nontraditional paths to a degree. Of the total enrollment, more than 100,000 students are 24 years or older, reflecting State University's services to specific constituencies, such as refresher courses for the professional community, continuing education opportunities for returning service personnel, and personal enrichment for more mature persons.

State University's research contributions are helping to solve some of modern society's most urgent problems. It was a State University scientist who first warned the world of potentially harmful mercury deposits in canned fish, and another who made the connection between automobile and industrial exhaust combining to cause changes in weather patterns. Other University researchers continue important studies in such wide-ranging areasas immunology, marine biology, sickle-cell anemia, and organ transplantation.

More than 1,000 Public Service activities are currently being pursued on State University campuses. Examples of these efforts include special training courses for local government personnel, State civil service personnel, and the unemployed; participation by campus personnel in joint community planning or project work, and campus-community arrangements for community use of campus facilities.

A distinguished faculty includes nationally and internationally recognized figures in all the major disciplines. Their efforts are recognized each year in the form of such prestigious awards as Fulbright-Hays, Guggenheim, and Danforth Fellowships.

The University offers a wide diversity of what are considered the more conventional career fields, such as business, engineering, medicine, teaching, literature, dairy farming, medical technology, accounting, social work, forestry, and automotive technology. Additionally, its responsiveness to progress in all areas of learning and to tomorrow's developing societal needs has resulted in concentrations which include pollution, urban studies, computer science, immunology, preservation of national resources, and microbiology.

SUNY programs for the educationally and economically disadvantaged have become models for delivering better learning opportunities to a once-forgotten segment of society. Educational Opportunity Centers offer high school equivalency and college preparatory courses to provide young people and adults with the opportunity to begin college or to learn marketable skills. In addition, campus based Educational Opportunity Programs provide counseling, developmental education and financial aid to disadvantage students in traditional degree programs.

Overall, at its EOC's, two-year college, four-year campuses and university and medical centers, the University offers 3,600 academic programs. Degree opportunities range from two-year associate programs to doctoral studies offered at 12 senior campuses.

The 30 two-year community colleges operating under the program of State University play a unique role in the expansion of educational opportunity. They provide local industry with trained technicians in a wide variety of occupational curriculums, and offer transfer options to students who wish to go on and earn advanced degrees.

The University passed a major milestone in 1985 when it graduated its one-millionth alumnus. The majority of SUNY graduates pursue careers in communities across the State.

State University is governed by a Board of Trustees, appointed by the Governor, which directly determines the policies to be followed by the 34 State-supported campuses. Community colleges have their own local boards of trustees whose relationship to the SUNY board is defined by law. The State contributes one-third

to 40 percent of their operating cost and one-half of their capital costs.

The State University motto is: "To Learn - To Search - To Serve."

STATE UNIVERSITY OF NEW YORK

UNIVERSITY CENTERS

State University of New York at Albany
State University of New York at Binghamton
State University of New York at Buffalo
State University of New York at Stony Brook

COLLEGES OF ARTS AND SCIENCE

State University College at Brockport
State University College at Buffalo
State University College at Cortland
State University of New York Empire State College
State University College at Fredonia
State University College at Geneseo
State University College at New Paltz
State University College at Old Westbury
State University College at Oneonta
State University College at Oswego
State University College at Plattsburgh
State University College at Potsdam
State University College at Purchase

COLLEGES AND CENTERS FOR THE HEALTH SCIENCES

State University of New York Health Science Center at Brooklyn
State University of New York Health Science Center at Syracuse
State University of New York College of Optometry at New York City
(Health Sciences Center at SUNY at Buffalo)*
(Health Sciences Center at SUNY at Stony Brook)*

COLLEGES OF TECHNOLOGY and COLLEGES OF AGRICULTURE AND TECHNOLOGY

State University of New York College of Technology at Alfred
State University of New York College of Technology at Canton
State University of New York College of Agriculture and Technology at Cobleskill
State University of New York College of Technology at Delhi
State University of New York College of Technology at Farmingdale
State University of New York College of Agriculture and Technology at Morrisville
State University of New York College of Technology at Utica/Rome**
(Upper-division and master's programs)
(Fashion Institute of Technology at New York City)***

SPECIALIZED COLLEGES

State University of New York College of Environmental Science and Forestry at Syracuse
State University of New York Maritime College at Fort Schuyler

STATUTORY COLLEGES****

NYS College of Agriculture and Life Sciences at Cornell University
NYS College of Ceramics at Alfred University
NYS College of Human Ecology at Cornell University
NYS School of Industrial and Labor Relations at Cornell University
NYS College of Veterinary Medicine at Cornell University

COMMUNITY COLLEGES

(Locally-sponsored, two-year colleges under the program of State University)

Adirondack Community College at Glens Falls
Broome Community College at Binghamton
Cayuga County Community College at Auburn
Clinton Community College at Plattsburgh
Columbia-Greene Community College at Hudson
Community College of the Finger Lakes at Canandaigua
Corning Community College at Corning
Dutchess Community College at Poughkeepsie
Erie Community College at Williamsville, Buffalo and Orchard Park
Fashion Institute of Technology at New York City***
Fulton-Montgomery Community College at Johnstown
Genesee Community College at Batavia
Herkimer County Community College at Herkimer
Hudson Valley Community College at Troy
Jamestown Community College at Jamestown
Jefferson Community College at Watertown
Mohawk Valley Community College at Utica
Monroe Community College at Rochester
Nassau Community College at Garden City
Niagara County Community College at Sanborn
North Country Community College at Saranac Lake
Onondaga Community College at Syracuse
Orange County Community College at Middletown
Rockland Community College at Suffern
Schenectady County Community College at Schenectady
Suffolk County Community College at Selden, Riverhead and Brentwood
Sullivan County Community College at Loch Sheldrake
Tompkins Cortland Community College at Dryden
Ulster County Community College at Stone Ridge
Westchester Community College at Valhalla

*The Health Sciences Centers at Buffalo and Stony Brook are operated under the administration of their respective University Centers.

**This is an upper-division institution authorized to offer baccalaureate and master's degree programs.

***While authorized to offer such baccalaureate and master's degree programs as may be approved pursuant to the provisions of the Master Plan, in addition to the associate degree, the Fashion Institute of Technology is financed and administered in the manner provided for community colleges.

****These operate as "contract colleges" on the campuses of independent universities.

College of Environmental Science and Forestry

COLLEGE ADMINISTRATION

President .... ROSS S. WHALEY
Director of News and Publications .... JERI LYNN SMITH
Director of Development .... ARTHUR J. FRITZ, JR.
Assistant to the President for Planning and Director of Institutional Research .... MAUREEN O. FELLOWS
Provost/Vice President for Academic Affairs .... WILLIAM P. TULLY
Dean of Instruction and Graduate Studies .... ROBERT H. FREY
Director of Libraries and Learning Resources Center .... DONALD F. WEBSTER
Dean of Nonresident Programs and Continuing Education .... ROBERT C. KOEPPER
Dean of Research .... HELMUTH RESCH
Director of Institute of Environmental Policy and Planning .... RICHARD C. SMARDON
Director of Analytical and Technical Services .... DAVID A. DRISCOLL
Chair, Chemistry Faculty .... ANATOLE SARKO
Director, Polymer Research Institute .... ISRAEL CABASSO
Director, Cellulose Research Institute .... TORE E. TIMELL
Chair, Environmental and Forest Biology Faculty and Director, Division of Forest Resources .... ROBERT L. BURGESS
Director, Adirondack Ecological Center .... WILLIAM F. PORTER
Chair, Environmental Studies Faculty .... ROBERT D. HENNIGAN
Chair, Forest Engineering Faculty .... ROBERT H. BROCK, JR.
Chair, Forestry Faculty .... BOB G. BLACKMON
Director, Forest Technology Program of the Forestry Faculty .... RICHARD W. MILLER
Chair, Landscape Architecture Faculty .... RICHARD S. HAWKS
Chair, Paper Science and Engineering Faculty .... LELAND R. SCHROEDER
Director, Empire State Paper Research Institute .... LELAND R. SCHROEDER
Chair, Wood Products Engineering Faculty LEONARD A. SMITH
Director, N. C. Brown Center for Ultrastructure Studies .... ROBERT B. HANNA
Director, Tropical Timber Information Center .... ROBERT W. MEYER
Vice President for Administration .... NICK J. PARADISO, JR.
Director of Administrative Computing .... DAVID J. SODERBERG
Director of Business Affairs .... MARK P. FENNESSY
Director of Forest Properties .... RICHARD A. SCHWAB
Director of Personnel and Affirmative Action .... MARCIA JAMES
Director of Physical Plant .... JAMES R. VESPI
Director of Public Safety .... KEVIN E. WALSH
Vice President for Student Affairs and Educational Services .... JAMES M. HEFFERNAN
Director of Admissions .... DENNIS O. STRATTON
Director of Alumni Affairs .... JUSTIN F. CULKOWSKI
Director of Career Planning .... THOMAS O. SLOCUM
Director of Financial Aid and Educational Opportunity Program .... JOHN E. VIEW
College Registrar .... ROBERT S. NORTH
Coordinator of Student Activities and Organizations .... PATRICIA ST. GERMAIN
Project Leader, U.S. Forest Service Cooperative Research Unit .... ROWAN A. ROWNTREE
Co-Directors, Great Lakes Research Consortium .... RICHARD C. SMARDON
.... ROBERT G. WERNER

COLLEGE FACULTY AND PROFESSIONAL STAFF

DISTINGUISHED TEACHING PROFESSOR

GEORGE W. CURRY, *Distinguished Teaching Professor,* Landscape Architecture Faculty

DANIEL L. DINDAL, *Distinguished Teaching Professor,* Environmental and Forest Biology Faculty

MIKLOS A. J. GRATZER, *Distinguished Teaching Professor,* Forestry Faculty

DISTINGUISHED ADJUNCT PROFESSOR

HARRY L. FRISCH, *Distinguished Adjunct Professor,* Chemistry Faculty

DISTINGUISHED SERVICE PROFESSOR EMERITUS

WILFRED A. CÔTÉ, JR., *Distinguished Service Professor,* Wood Products Engineering Faculty

DISTINGUISHED TEACHING PROFESSOR EMERITUS

EDWIN H. KETCHLEDGE, *Distinguished Teaching Professor Emeritus,* Environmental and Forest Biology Faculty

THEODORE J. STENUF, *Distinguished Teaching Professor Emeritus,* Paper Science and Engineering Faculty

DISTINGUISHED PROFESSOR EMERITUS

CONRAD SCHUERCH, *Distinguished Professor Emeritus,* Chemistry Faculty

MICHAEL M. SZWARC, *Distinguished Professor Emeritus,* Polymer Research Institute.

FACULTY AND PROFESSIONAL STAFF

This listing represents an official record of the State University of New York College of Environmental Science and Forestry faculty and professional staff for 1991. It is designed for use in 1991-92.

The date in parentheses after each name denotes the first year of service, two or more dates, the term of service.

LAWRENCE P. ABRAHAMSON (1977), *Senior Research Associate,* Forestry Faculty and Environmental and Forest Biology Faculty; B.S., Michigan Technological University, 1964; M.S., University of Wisconsin, 1967; Ph.D., 1969

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THEODORE J. KOCHANEK (1971-1976), *Director of Physical Plant Emeritus*

RONALD F. LAPLAINE (1948-1983), *Technical Specialist Emeritus*, Department of Paper Science and Engineering

CHARLES C. LARSON (1950-1983), *Professor Emeritus;* A.S., North Dakota State School of Forestry, 1938; B.S., University of Minnesota, 1940; M.S., University of Vermont, 1943; Ph.D., State University of New York College of Forestry, 1952

ORRIN L. LATHAM (1930-1966), *Associate Professor Emeritus;* B.S.F., Iowa State College, 1927; Yale University, 1932

RICHARD V. LEA (1967-1985), *Professor Emeritus*; B.S., State University of New York College of Forestry, 1946; M.S., 1948; Ph.D., 1953

BENGT LEOPOLD (1961-1985), *Professor Emeritus;* B.Sc., Royal Institute of Technology, Stockholm, 1947; Licentiat, 1949; Ph.D., 1952

JOSIAH L. LOWE (1933-1975), *Professor Emeritus*; B.S., New York State College of Forestry, 1927; Ph.D., University of Michigan, 1938

AUBREY H. MACANDREWS (1926-1962), *Professor Emeritus;* Truro Agriculture College, 1922; B.S., New York State College of Forestry, 1925; M.S., 1926

RAYMOND L. MARLER (1970-1981), *Senior Research Associate* Emeritus; B.S., University of Michigan, 1948; M.F., 1948

CHARLES E. MARTIN II (1962), *Professor*, Forest Technology Program of the Forestry Faculty; B.S., Duke University, 1953; M.F., 1954

RENATA MARTON (1957), *Senior Research Associate Emeritus;* Master Ph. (Chemistry), Jagiello University, 1934; Ph.D., 1936

JOHN A. MEYER (1958-1985), *Associate Director Emeritus, Senior Research Associate* and *Professor Emeritus;* B.S., Pennsylvania State College, 1949; M.S., 1950; Ph.D., State University of New York College of Forestry, 1958; Chancellor's Award for Excellence in Professional Service, 1977

HOWARD C. MILLER (1950-1982), *Professor* and *Extension Specialist Emeritus*; B.S., New York State College of Forestry, 1941; Ph.D., Cornell University, 1951

RAYMOND A. MOORE (1954-1985), *Associate Professor Emeritus;* B.S.F., West Virginia University, 1951; M.S., North Carolina State College, 1952

JOHN L. MORRISON (1946-1971), *Professor Emeritus;* A.B., University of Nebraska, 1933; A.M., 1935; Ph.D., University of California, 1941

HARRISON H. PAYNE (1964-1987), *Vice President for Student Affairs* and *Professor Emeritus;* B.S., State University of New York College of Forestry, 1950; M.Ed., St. Lawrence University, 1955; Ed.D., Cornell University, 1963

RICHARD E. PENTONEY (1953-1979), *Vice President for Program Affairs Emeritus;* B.S., University of California, 1949; M.S., State University of New York College of Forestry, 1952; Ph.D., 1956

JANIS PETRICEKS (1968), *Professor Emeritus*, Forestry Faculty; Diploma in Forestry, University of Freiburg, 1950; M. Agr., Interamerican Institute of Agricultural Sciences, 1956; Ph.D., State University of New York College of Forestry, 1968

ROBERT B. RAYMISH (1956-1983), *Assistant Director of Physical Plant Emeritus*, Office of the Vice President for Administration and Services

SAMUEL ROTHENBERG (1946-1986), *Senior Research Associate Emeritus;* B.S., State University of New York College of Forestry, 1943; M.S., 1964

CONRAD SCHUERCH (1949-1983), *Distinguished Professor Emeritus;* B.S., Massachusetts Institute of Technology, 1940; Ph.D., 1947

BRADFORD G. SEARS (1941-1976), *Dean Emeritus; Professor Emeritus;* B.S., New York State College of Forestry, 1939; M.S., State niversity of New York College of Forestry, 1948

HARDY L. SHIRLEY (1945-1967), *Dean Emeritus; Professor Emeritus;* B.A., Indiana University, 1922; Ph.D., Yale University, 1928; D.h.c., University of Helsinki, 1958; D.Sc., Syracuse University, 1966

JOHN F. SIAU (1963-1964) (1965) (1966-1985), *Professor Emeritus;* B.S., Michigan State College, 1943; M.S., State University of New York College of Forestry, 1965; Ph.D., 1968

SAVEL B. SILVERBORG (1947-1977), *Professor Emeritus*; B.S., University of Idaho, 1936; Ph.D., University of Minnesota, 1948

ROBERT M. SILVERSTEIN (1969-1986), *Professor Emeritus;* B.S., University of Pennsylvania, 1937; M.S., New York University, 1941; Ph.D., 1949

JOHN B. SIMEONE (1948-1983), *Professor Emeritus;* B.S., Rhode Island State College, 1942; M.F., Yale University, 1948; Ph.D., Cornell University, 1960

CHRISTEN SKAAR (1946-1948) (1949-1976), *Professor Emeritus;* B.S., New York State College of Forestry, 1943; M.S., State University of New York College of Forestry, 1948; Ph.D., Yale University, 1957

LEROY C. STEGEMAN (1929-1965), *Professor Emeritus;* B.S., Michigan State College, 1928; M.S., University of Michigan, 1929

THEODORE J. STENUF (1960-1988), *Distinguished Teaching Professor Emeritus;* B.Ch.E., Syracuse University, 1949; M.Ch.E., 1951; Ph.D., 1953

WESLEY E. SUHR (1974-1988), *Associate Professor Emeritus;* B.S., University of Minnesota, 1958; M.S., University of Arizona, 1965

VIVIAN R. SUTTON (1962-1976), *Associate Professor Emeritus;* B.A., Oberlin College, 1934; M.A., Bryn Mawr College, 1937; Ph.D., 1942

MICHAEL M. SZWARC (1952-1979), *Distinguished Professor Emeritus;* Ch.E., Warsaw Polytechnic College, 1932; Ph.D., Hebrew University, 1945; Ph.D., Manchester University, 1947; D.Sc., 1949

WILLIAM C. TIERSON (1949-1983), *Director of Wildlife Research Emeritus;* B.S., State University of New York College of Forestry, 1949; M.F., 1967

LESLIE L. TURAI (1976-1982), *Professor Emeritus;* B.S., University of Debrecen, 1936; M.S., 1937; Ph.D., University of Budapest, 1938

ARTHUR T. VIERTEL (1946-1975), *Associate Professor Emeritus;* B.S., New York State College of Forestry, 1942; Ph.D., State University of New York College of Forestry, 1954

WILLIAM L. WEBB (1937-1975), *Professor Emeritus; Dean Emeritus;* B.S., University of Minnesota, 1935; M.S., 1940; Ph.D., Syracuse University, 1950

WALTER L. WELCH (1950-1965), *Associate Professor Emeritus;* A.B., Syracuse University, 1946

SIDNEY A. WHITT (1968-1976), *Professor Emeritus;* B.S., University of Alabama, 1933; M.S., Massachusetts Institute of Technology, 1937; D. Engr. Sc., New York University, 1962

HUGH E. WILCOX (1954-1986), *Professor Emeritus;* B.S., University of California, 1938; M.S., New York State College of Forestry, 1940; Ph.D., University of California, 1950

JOHN M. YAVORSKY (1948-56) (1967-1984), *Professor and Dean of Continuing Education Emeritus;* B.S., New York State College of Forestry, 1942; M.S., 1947; Ph.D., State University of New York College of Forestry, 1955

ROBERT A. ZABEL (1947-1985), *Professor Emeritus;* B.S., University of Minnesota, 1938; M.S., New York State College of Forestry, 1941; Ph.D., State University of New York College of Forestry, 1948

ADDITIONAL INFORMATION

Additional information is available upon request from any of the addresses found on the inside front cover. This undergraduate/graduate catalog was published by the College of Environmental Science and Forestry, August 1991.

The calendar, courses, tuition, and fees described in this catalog are subject to change at any time by official action either of the State University of New York Board of Trustees or of the College of Environmental Science and Forestry.

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ACCREDITATION

The State University of New York College of Environmental Science and Forestry is accredited by the Middle States Association of Colleges and Secondary Schools: the B.S. degree program in Forestry is accredited by the Society of American Foresters; the A.A.S. degree program in Forest Technology is recognized by the Society of American Foresters; the B.L.A. and M.L.A. degree programs in landscape architecture are accredited by the American Society of Landscape Architects; and the B.S. degree program in forest engineering is accredited by the Accreditation Board for Engineering and Technology.

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AFFIRMATIVE ACTION

The State University of New York College of Environmental Science and Forestry seeks to take affirmative action to provide opportunities to all people and to reflect in our campus community the cultural diversity of the population we serve. ESF is committed to recruiting and retaining women and underrepresented group members as students, faculty and staff. As an Equal Employment Opportunity employer and educational institution, the College does not discriminate on the basis of age, disability, marital status, national origin, race, color, religion, creed, sex, sexual orientation or veteran's status.

Coordinator for 503-504 Programs Nick J. Paradiso, Jr., Vice President for Administration, 209 Bray Hall.

Affirmative Action Officer Judith J.Kimberlin, Assistant Director of Personnel and Affirmative Action, 217 Bray Hall.

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COLLEGEWIDE SMOKING POLICY

To help ensure the safety, quality and healthfulness of the teaching, learning and working conditions at the SUNY College of Environmental Science and Forestry, smoking within college owned and controlled buidings and facilities and college-owned vehicles will not be permitted except in explicitly designated areas.

State University of New York
College of Environmental Science and Forestry
1 Forestry Drive
Syracuse, New York 13210 - 2778

1992 - 93 Catalog

State University of New York College of

Environmental Science and Forestry

Correspondence Directory

All written correspondence directed to a staff or faculty member at ESF should be addressed to that person and mailed to 1 Forestry Drive, Syracuse, New York 13210-2778.

Please note the specific telephone number and zip code for the following offices and individuals:

Information: (315) 470-6500

Academic Programs: (315) 470-6599, zip code 13210-2781
    Robert H. Frey, Dean, Instruction and Graduate Programs

Admissions
    Undergraduate: (315) 470-6600, zip code 13210-2779
        Dennis O.Stratton, Director
        Susan H. Sanford, Associate Director
        Mary O'Halloran, Senior Admissions Advisor
        Eva D. Williams, Senior Admissions Advisor

    Graduate: (315) 470-6599, zip code 13210-2781
        Robert H. Frey, Dean, Instruction and Graduate Studies

Bursar: (315) 470-6652, zip code 13210-2780
    Mary Anne T. Marano, Bursar

Career and Counseling Services: (315) 470-6660, zip code 13210-2783
    Thomas O. Slocum, Director, Career and Counseling Services

Continuing Education: (315) 470-6891, zip code 13210-2784
    Robert C. Koepper, Dean, Nonresident Programs
    Horace B. Shaw III, Associate, Continuing Education

Educational Opportunity Program (EOP): (315) 470-6670, zip code 13210-2783
    John E. View, Director, Financial Aid and Educational Opportunity Program

Faculty Chairs (see specific Faculty listing in catalog)

Financial Aid: (315) 470-6670, zip code 13210-2783
    John E. View, Director, Financial Aid and Educational Opportunity Program
    Marilyn L. Wright, Assistant Director, Financial Aid
    Judith C. Hamilton, Financial Aid Advisor

Public Safety: (315) 470-6669
    Kevin E. Walsh, Director, Campus Public Safety

Registrar: (315) 470-6663, zip code 13210-2783
    Robert S. North, College Registrar
    Raymond W. Blaskiewicz, Associate Registrar

Research Programs: (315) 470-6606
    Vacant, Dean, Research
    J. Donald Mabie, Senior Staff Associate

Student Activities: (315) 470-6658, zip code 13210-2783
    Vacant, Coordinator, Student Activities and Organizations

Veterans Affairs: (315) 470-6663, zip code 13210-2783
    Robert S. North, College Registrar

State University of New York
College of Environmental Science and Forestry
1992-93 General Catalog

Academic Calendar

SYRACUSE CAMPUS

FALL 1992

New Student Orientation Program	Aug. 28-31	Friday-Monday
Academic Advising	Aug. 31	Monday
Registration for New Students	Aug. 31	Monday
Classes Begin	Sept. 1	Tuesday
Labor Day (No classes)	Sept. 7	Monday
Fall Break	Oct. 17 - 19	Saturday -Monday
Thanksgiving Recess	Nov. 25-Nov. 29	Wednesday-Sunday
Registration for Spring 1993	Nov. 30-Dec. 11	Monday-Friday
Last Day of Classes	Dec. 15	Tuesday
Reading Day	Dec. 16	Wednesday
Exam Period	Dec. 17-23	Thursday-Wednesday

SPRING 1993

Orientation and Advising for New Students	Jan.11	Monday
Registration for New Students	Jan. 11	Monday
Classes Begin	Jan. 12	Tuesday
Martin Luther King Day (No classes)	Jan. 18	Monday
Spring Recess	Mar. 6-14	Saturday-Sunday
Registration for Fall 1993	Apr. 5-14	Monday-Wednesday
Easter Break	April 9	Friday
Last Day of Classes	Apr. 28	Wednesday
Reading Day	Apr. 29	Thursday
Exam Period	Apr. 30-May 6	Friday-Thursday
Commencement	May 9	Sunday

WANAKENA CAMPUS

FALL 1992

Campus Opens	Aug. 17	Monday
Classes Begin	Aug. 18	Tuesday
Thanksgiving Recess	Nov. 25 -29	Wednesday-Sunday
Semester Ends	Dec. 18	Friday

SPRING 1993

Classes Begin	Jan. 19	Tuesday
Spring Break	Mar. 27 - Apr. 4	Saturday-Sunday
Graduation	May 29	Saturday

ESF: A Vibrant Place

The State University of New York College of Environmental Science and Forestry (ESF) offers students a world that can parallel their fields of study by spanning the globe or remaining as focused as a microscope. An enrollment of 1,800 students and the 12-acre main campus in Syracuse are dwarfed by ESF's international reputation and its 25,000 acres at campuses and field stations throughout the state.

The College provides students and faculty with all the advantages of the SUNY system and adjacent Syracuse University, as well as one of the most intimate atmospheres of any doctoral granting institution. Students can enjoy their own quiet campus and green quad, while exchanging ideas about the natural world with faculty and classmates focused on the same critical issues. Students at ESF also mix with Syracuse University students in classrooms on both campuses, and at the schools' top-notch facilities. In a very real sense, ESF students have the best of both worlds—the intimacy and intellectual atmosphere of a small dynamic college with annual research awards totaling more than $12 million, and the exciting atmosphere of a major private university.

As the 21st century looms and society becomes increasingly concerned about the environment, members of the ESF family also have timing in their favor. The future of the world may be determined by those who have broad foresight and a balance of judgment in applying scientific, technical, and sociological knowledge to guide environmental and human forces. Modern civilization with its compelling demands from industry and government needs people who think objectively and constructively, and act creatively and responsibly. From its start in 1911, the College has served the state, nation, and world in meeting the needs of its citizens through education, research, and public service. Faculty and students at ESF are committed to resolving immediate environmental hazards, learning how to avoid future problems, and offering policy alternatives that will both protect the environment and meet the needs of a global society.

At the undergraduate level, ESF offers curricula in the areas of resource management, engineering, environmental design, and the physical and life sciences. The College prepares graduates to enter the professional world or further pursue their education in graduate school.

The College supports graduate degree programs in six major program areas: environmental and forest biology, forest chemistry, forest resources management, environmental and resource engineering, landscape architecture, and environmental science. Graduate students work purposefully toward a specific goal, while sharpening their ability to think critically and analytically, conduct research, and use basic research tools as well as specialized equipment.

Both the undergraduate and graduate programs, which attracted 147 international students from 38 different countries in the fall of 1991, reflect the efforts of the College's faculty and students to work together to maintain a tradition of academic and professional excellence.

This Catalog provides an introduction to the College, and its programs of undergraduate and graduate study, research, and public service. It only begins to suggest the breadth and diversity of the faculty, students, and programs that prepare ESF graduates for the environmental challenges of the 1990s and beyond.

What's In A Name?

Establishing a Tradition

As the State University of New York College of Environmental Science and Forestry has evolved over its 80-year history, so has its name.

The College was founded in 1911 through the efforts of Syracuse University Chancellor James R. Day and community leaders who were attuned to a growing national sentiment in favor of forest conservation, and sensed the need for a professional school of forestry.

The legislative act which created the New York State College of Forestry at Syracuse University referred to it as the state's "institution for educational work in forestry." The act also instructed faculty to "conduct such special research in statewide investigations in forestry as will throw light upon and help in the solution of forestry problems."

Chancellor Day's early support led to a long history of cooperation between the College and Syracuse University. This relationship remains among the nation's most outstanding examples of collaboration between public and private institutions of higher education. Since its opening, the College has purchased major portions of its supportive curriculum from Syracuse University, which has enabled ESF to more fully develop its undergraduate and graduate level programs.

Since its beginning under Dean Hugh P. Baker, the College has responded to the broad needs of environmental professionalism. As other forestry schools became more specialized, ESF broadened its scope to include such essentials of environmental science as design, engineering, life sciences, and resource management.

In 1948, the State University of New York was formed to coordinate public higher education throughout the state, and the College's name became the State University College of Forestry at Syracuse University. The College, which has always been state-supported and is governed by a Board of Trustees comprised of nine members appointed by the governor and six *ex officio* members, was also recognized as a specialized college within the state system.

The name evolved further in 1972 when it was rechartered as the State University of New York College of Environmental Science and Forestry to reflect more deeply the traditional grounding forestry has in the environment, and to illuminate the breadth of ESF's programs.

For over 80 years, the full thrust of the College of Environmental Science and Forestry has been focused on the environment, on all of its six campuses, and in each of its missions: instruction, research, and public service.

The College is a doctoral granting institution with highly focused academic and professional programs that continues to be devoted to the advancement of environmental science and forestry, but places instruction at the top of its list of priorities.

Significant Events

1911 — Governor John A. Dix enacts legislation establishing the New York State College of Forestry at Syracuse University.

1948 —Legislative action incorporates all state-supported higher education into the State University of New York, and the College's name becomes the State University College of Forestry at Syracuse University.

1972 —By special legislative act, the College is rechartered as the State University of New York College of Environmental Science and Forestry.

The Mission: Instruction, Research, and Public Service

The mission of the State University of New York College of Environmental Science and Forestry is to be a world leader in instruction, research, and public service related to:

- Understanding the structure and function of the world's ecosystems;
- Developing, managing, and use of renewable natural resources;
- Improving outdoor environments ranging from wilderness to managed forests to urban landscapes;
- Maintaining and enhancing biological diversity, environmental quality, and resource options.

Instruction

Undergraduate Education

Associate in Applied Science Degree

Since 1912, the College has been training forest technicians on its 2,800-acre Wanakena Campus in the Adirondack Mountains. It is the oldest ranger school in the United States, and offers a two-year forest technology curriculum that provides graduates with an associate in applied science degree.

The curriculum requires students to take their first year of general education at a two- or four-year college. The second year, which emphasizes practical field training in the relationships between forest technology and managerial needs, is taken at Wanakena.

Graduates of this degree program in practical forestry are prepared for the following positions: forest ranger; federal, state or private industry forest technician or forestry aide; district forest supervisor; timber inventory specialist; timber sales supervisor; forest surveyor or engineering aide; or forest protection technician.

Bachelor's Degree

At the baccalaureate level, the College offers professional study in eight areas: chemistry, environmental and forest biology, environmental studies, forest engineering, landscape architecture, paper science and engineering, resource management, and wood products engineering. In addition, the College offers a dual option that combines both environmental and forest biology and resource management. These programs are registered with the New York State Education Department.

These curricula generally lead to a bachelor of science degree. In the case of landscape architecture, which is a five-year program, a bachelor of landscape architecture degree is awarded. In the forest engineering program, a fifth year leading to a bachelor's degree in civil engineering can be taken at Syracuse University or the State University of New York at Buffalo.

Graduate Education

The College awarded its first graduate degree in 1913. Today, ESF offers advanced degrees in six major program areas: environmental and forest biology, environmental and resource engineering, environmental science, forest chemistry, forest resources management, and landscape architecture. These programs are registered with the New York State Education Department.

Graduate study leads to the master of science degree, master of forestry degree, master of landscape architecture degree, and doctor of philosophy degree. A postdoctoral study program, closely related to the College's research effort, is also available.

Degree Programs and Areas of Study

The College is authorized to award degrees in the following programs. Enrollment in other than registered or otherwise approved programs may jeopardize a student's eligibility for certain financial aid programs.

Division of Engineering, page 57.

Environmental and Resource Engineering: M.S., Ph.D., with option in *forest engineering* and areas of study in environmental management, forest engineering, geo-spatial information systems, photogrammetry and remote sensing, or water resources engineering; option in *paper science and engineering* and areas of study in chemistry of pulping and bleaching, colloid chemistry and fiber flocculation, fiber and paper mechanics, process

and environmental systems engineering, or pulp and paper technology; and option in *wood products engineering* with areas of study in wood science and technology, wood anatomy and ultrastructure, tropical timbers, wood treatments, or engineered wood products and structures: timber structure design. (HEGIS Code 0999)

Division of Forest Resources, page 63.

Dual Option in Environmental and Forest Biology/Resources Management: B.S. (HEGIS Codes 0499 and 0115)

Faculty of Chemistry, page 66.

Chemistry: B.S., with options in biochemistry and natural products, environmental chemistry, or natural and synthetic polymer chemistry. (HEGIS Code 1905)

Forest Chemistry: M.S., Ph.D., with areas of study in biochemistry, environmental chemistry, organic chemistry of natural products, or polymer chemistry. (HEGIS Code 1905)

Faculty of Environmental and Forest Biology, page 72.

Environmental and Forest Biology: B.S., with elective concentrations in ecology, entomology, environmental microbiology, fish and wildlife biology and management, pest management, forest pathology and mycology, plant physiology, plant science, premedical science, education, or zoology. An accelerated B.S./M.S. track in plant biotechnology is also available. (HEGIS Code 0499)

Environmental and Forest Biology: M.S., Ph.D., with areas of study in ecology, entomology, environmental physiology, fish and wildlife biology and management, forest pathology and mycology, plant science and biotechnology, soil ecology, or chemical ecology. (HEGIS Code 0499)

Faculty of Environmental Studies, page 80.

Environmental Studies: B.S., with options in information and technology, land use planning, biological science applications, policy and management. (HEGIS Code 0420)

Graduate Program in Environmental Science: M.S., Ph.D., with areas of study in environmental land planning, environmental policy and democratic processes, environmental modeling and risk analysis, or water resource management. (HEGIS Code 0420)

Faculty of Forest Engineering, page 86.

Forest Engineering: B.S. (HEGIS Code 0999)

Faculty of Forestry, page 89.

Forest Technology Program: A.A.S. (HEGIS Code 5403)

Resources Management—General Forestry: B.S., with a minor in management (HEGIS Code 0115)

Forest Management and Operations: M.F., with areas of study in the public sector, or the private sector. (HEGIS Code 0115)

Forest Resources Management: M.S., Ph.D., with areas of study in policy and administration, forestry economics, forest management, recreation management, watershed management/hydrology, silviculture, silvics, forest soil science, tree improvement, international forestry, urban forestry, quantitative methods, or resources information management. (HEGIS Code 0115)

Faculty of Landscape Architecture, page 105.

Landscape Architecture: B.L.A. (HEGIS Code 0204)

Landscape Architecture: M.L.A. (HEGIS Code 0204)

Faculty of Paper Science and Engineering, page 112.

Paper Science and Engineering: B.S., with options in science, or engineering, and a minor in management. (HEGIS Code 0999)

Faculty of Wood Products Engineering, page 118.

Wood Products Engineering: B.S., with options in construction, or wood products. (HEGIS Code 0999)

Research

The College's commitment to scientific inquiry stretches back to its second year of existence. In 1912, Dean Hugh P. Baker initiated the College's first research project by joining forces with the U.S. Forest Service in a study designed to determine the species and quantities of wood being used by firms in New York State.

Since that date, ESF's research programs have attracted a worldwide clientele of industrial, governmental, professional, and scientific groups, and through liaison with them, the program maintains its vigor and relevancy to the world's most important environmental issues. Support from this clientele amounts to more than $5 million per year.

Students and faculty from across the College contribute to the depth and diversity of the research program. Findings from these studies are applied to a host of issues and problems through various demonstrations and communication networks. Recent examples include studies of the following: the impact of acid precipitation on forest ecosystems, the restoration of the lynx in the Adirondacks, the development of a system for integrating wildlife with forest management, the natural production of migratory fish in lakes and streams, the development of a forest resource management and planning support system, new wood pulping and bleaching processes leading to pollution-free water and air effluents, the development of polymeric materials for artificial human organs, and the evaluation of a radio-frequency drying method for lumber.

Empire State Paper Research Institute

The Empire State Paper Research Institute (ESPRI) is a research organization serving the pulp and paper field on a worldwide basis. It performs investigations in cooperation with the Empire State Paper Research Associates (ESPRA) whose members represent pulp and paper companies and allied industries of the world. The Institute was established in 1945 when members of ESPRA recognized the need for new scientific and technical knowledge and methods. Since then, ESPRI has been able to maintain an efficient balance between the practical and theoretical bases of the pulp and paper industry.

The Institute is housed in the modern J. Henry Walters Hall, which has its own pilot paper mill and is staffed by internationally recognized scientists. The Institute provides a research base for long-range industry development, and its program has widened in scope to cover varied aspects of pulping and papermaking, including environmental considerations, recycling, raw material conservation, and cutting edge technology to improve the processes and products.

Polymer Research Institute

Scientists at the College have made many original contributions to the field of pure and applied polymer chemistry, including the development of living polymers, the study of anionic polymerization and electron-transfer initiation, and work on the permeation of gases and films through polymeric films.

The College faculty specializing in polymer chemistry has trained hundreds of graduates and postdoctoral researchers, many of whom now hold leading positions in universities and industrial and governmental laboratories.

N. C. Brown Center for Ultrastructure Studies

The N.C. Brown Center, located in Baker Laboratory, is a teaching, research, and service facility. It is equipped to provide students, faculty, and research staff with virtually every type of modern microscopy, including light microscopy, video microscopy, scanning electron microscopy, and transmission electron microscopy.

Among the major items of equipment in the Center are the following: a JEOL 2000EX 200-KV transmission electron microscope; an RCA EMU-4A transmission electron microscope; two ETEC Autoscan scanning electron microscopes with energy dispersive x-ray analyzer, wavelength x-ray analyzer, LeMont Scientific Image Analysis System, and microstages for mechanical testing of specimens within the scanning microscope chamber; high vacuum evaporators; microtomes; ultramicrotomes; and an array of specialized light microscopes, including a high resolution enhanced contrast video microscopy system.

The center's resources include specimen preparation rooms, photographic darkrooms, three electron microscope laboratories, and other supporting facilities. The primary service of the center is teaching, and course offerings include microscopy and photomicrography, scanning electron microscopy, transmission electron microscopy, and interpretation of ultrastructure. Research is a second major function, and the center provides support to students, research staff, and faculty who are conducting structural studies. Public service is extended to industry, regional medical facilities, and colleges, as well as to local high school groups and technology-oriented organizations.

Adirondack Ecological Center

The Adirondack Ecological Center (AEC) is located on the Huntington Wildlife Forest in the geographic center of the 6 million-acre Adirondack Park wilderness. The AEC provides a support base

for ecological research in the region, including housing, laboratory, computer, and library facilities.

A resident staff maintains an extensive historical database and conducts continuous monitoring of environmental variables, such as weather and atmospheric chemistry, vegetation, and wildlife populations. Currently, more than 100 students and scientists are conducting research at the center, and the projects range from the effects of acid precipitation on tree growth to restoration of moose and lynx populations in the Adirondack region. Most research is conducted by graduate students, but undergraduates are encouraged to become involved as seasonal field assistants. Between 40 and 60 students are in residence at various times throughout the year.

The Huntington Wildlife Forest, a 15,000-acre property owned by the College, provides an exceptional resource for experimentation in ecology and natural resources management. The forest contains Rich Lake and the new $1 million Adirondack Interpretive Center, which is operated by the Adirondack Park Agency and open to the public throughout the year.

Great Lakes Research Consortium

The Great Lakes Research Consortium (GLRC) involves 10 educational institutions in a collaborative effort to understand and improve the Great Lakes ecosystem. Headquartered at ESF, the consortium's other member institutions are the SUNY Colleges at Brockport, Buffalo, Fredonia, Geneseo and Oswego; the SUNY Centers at Buffalo and Albany; and Clarkson and Cornell universities. Six universities in the province of Ontario, Canada, also participate in the consortium.

The consortium's goals are to facilitate research and scholarship involving Great Lakes issues, the education of students on topics related to the Great Lakes ecosystem, and the dissemination of information gathered through consortium-sponsored research. The GLRC sponsors scholarly workshops, a cooperative grants program, a seminar series, and a newsletter. The consortium also manages several special projects including the Canada-U.S. Information Sharing Project on the Effects of Great Lakes Contaminants on Human Health, studies the role of non-governmental organizations in international policy, and provides a summer practicum in environmental analysis for undergraduate faculty.

Tropical Timber Information Center

The Tropical Timber Information Center (TTIC) provides identification of wood samples and information about general characteristics and technical properties of the world's timber. These services are directed toward the needs of importers and users of tropical woods.

The center began operation in 1975 as part of the Faculty of Wood Products Engineering, and is one of only two such sources of information in the western hemisphere. The center also carries out special studies under contract for production of data that is not available in the literature. The technical base for operation of the TTIC is the 35,000-specimen H.P. Brown Memorial Wood Collection of authenticated wood samples in the Faculty of Wood Products Engineering, and an extensive collection of reference materials in Moon Library. Both of these resources have been built up over the past 60 years by close cooperation with institutions throughout the world. Primary efforts at the center include responding to requests for services from users of tropical woods, expanding the collection, and developing an advanced computer system on properties and uses of the world's timbers.

The New York State Center for Hazardous Waste Management

The College is a partner in the New York State Center for Hazardous Waste Management, which is centered at SUNY Buffalo. The organization's long-term research and development goals include developing cost-effective technologies for neutralizing, recycling, or otherwise securely containing hazardous substances, and developing improved methods of safely storing and transporting toxic substances.

Faculty and staff at ESF represent an interdisciplinary group with expertise in areas that include biochemical toxicology, microbiology, environmental chemistry, sludge management, microbial ecology, and implementation considerations, including engineering and management components.

The College also publish the center's Waste Management Research Report, which is printed three times per year.

Initiative for Research on Energy and Material Conservation

The College has recently launched an Initiative for Research on Energy and Material Conservation

in the Forest Industries (REMCO). REMCO is aimed at achieving improved processing in the forest industries leading to wiser use of energy and materials.

The goals of the initiative are drawn broader than traditional industrial processing. It scope is to span the forest-related industries which manufacture products derived from wood, such as lumber, composition boards, plywood, and furniture. It also includes producers and converts of biomass. REMCO receives funding from a variety of federal, state, and private sector organizations.

Cellulose Research Institute

The Cellulose Research Institute is currently focusing its efforts on the fine structure of native cellulose and its transformations into other commercially important forms of cellulose.

For example, the structural differences between native and regenerated celluloses have been determined, for the first time, through X-ray crystallographic studies. The same techniques are now being used to study the structural aspects of cellulose mercerization, an important commercial process in cellulose chemistry. Other recent research has been concerned with the organization, chemical composition, and function of the vascular cambium in trees, which is the ultimate source of all wood and bark produced in nature.

U.S. Department of Agriculture Forest Service Cooperative Research Unit

The Northeastern Forest Experiment Station of the U.S. Forest Service maintains a research center at the College. Since 1978, the Cooperative Research Unit has been conducting research on urban environmental forestry problems. The center's efforts provide increased opportunities for faculty and students to collaborate with Forest Service scientists in studies of urban and environmental problems.

U.S. Department of the Interior National Park Service Cooperative Park Studies Unit

ESF has worked closely with the National Park Service since the mid 1980's, conducting research and supervising student internships in many of our national parks, from Acadia to Rocky Mountain National Parks. In 1992, the National Park Service and ESF established a Cooperative Park Studies Unit (CPSU) on the Syracuse campus.

The CPSU strengthens and broadens the historical linkages between the National Park Service and the College. The National Park Service brings experience in the management of large, biologically rich ecosystems, and the College provides one of the nation's largest programs focusing on ecology and landscape design. Major thrusts include the application of wildlife population dynamics, computer modeling, and landscape ecology to the environmental challenges now facing the national parks. As part of their academic programs, many undergraduate and graduate students gain experience with the national parks, serving on scientific studies, working as seasonal interns, or conducting graduate thesis research.

Graduate Education and Research Initiative

Governor Mario Cuomo and the New York State Legislature have supported the Graduate Education and Research Initiative (GERI), which is designed "to retain and attract premier faculty and graduate students, secure outside governmental and corporate support, and develop a university climate that spawns creativity."

To maximize the return on the state's contribution, SUNY's eight doctoral-granting campuses each have identified those centers of excellence or targets of opportunity in which they can make the most significant advances in research and graduate education and which hold the greatest potential for attracting additional resources to the State of New York. By focusing limited funds on carefully selected centers of excellence, the participating institutions maximize their contributions to the achievement of the initiative's broader goals, while remaining responsive to the needs of the specific areas they serve.

The College has advanced four programmatic themes: biotechnology in forestry, environmental systems science, polymer science and technology, and process engineering.

Biotechnology in Forestry

The biotechnology in forestry initiative is committed to the pursuit of excellence in graduate education and research in the general area of study, and to forging links with industries and governmental agencies concerned with forest biotechnology. The initiative is a multidisciplinary effort by the faculty of these four graduate programs: environmental and forest biology, forest

chemistry, forest resources management, and environmental and resource engineering. A major objective is to develop practical research to help meet state and national needs in forestry and forest product utilization.

An accelerated B.S./M.S. track in plant biotechnology in the environmental and forest biology graduate program, or an M.S. in one of the four graduate programs or a related discipline, can be followed by a Ph.D. program. Graduate research assistantships are available for outstanding students in fields related to forest biotechnology.

Under the initiative, research and its applications are focused on plant molecular biology; plant and pest interactions including fungi, bacteria, viruses, mycoplasma-like organisms, and insects; biomass and xenobiotic conversions; and forest products and productivity.

Faculty areas of research include the following: molecular taxonomy; transformations of trees and fungi; multicopy gene variability; molecular ecology and chemical messengers; molecular biology of fungi; construction of DNA vectors; fungal dsRNA and pheromones in biological control; *in vitro* selection for disease resistance; mechanisms of pathogenicity and disease resistance and their genetic control; tissue, shoot, protoplast, and single cell culture; bioconversion of lignocellulose and hemicelluloses; enzymatic photostabilization of paper pulp; microbial detoxification of hazardous wastes; trace metal metabolism by phytoplankton; microbial treatment of wastewater; and selection and breeding for wood quality, growth rate, and disease resistance.

Available facilities include: newly remodeled and equipped molecular biology research and teaching laboratories, a tissue culture clean room, controlled environment chambers, modern air-conditioned glasshouses, NMR and GC-mass spectrometers, HPLCs, fermentation systems, and radioisotope and ultrastructure laboratories. Access to the cell sorter and DNA and peptide synthesizers and sequencers at Syracuse University is also available.

Environmental Systems Science

Environmental systems science is the quantitative and integrative study of physical, chemical, biological, and social-economic processes and mechanisms applied to ecosystems. It is integrative because it draws from faculty and research activity in the Faculties of Chemistry, Environmental and Forest Biology, Environmental Studies, Forest Engineering, and Forestry.

The approach of the Faculty of Chemistry to environmental systems science emphasizes interactions between environmental processes and chemical elements and species in environmental systems. Current studies include behavior of trace organic contaminants in the Great Lakes, trace metal uptake by phytoplankton, characterization of natural organic compounds in water, identification and characterization of air and water particles, and development of improved sampling and analytic methods for air and water.

The Faculty of Environmental and Forest Biology stresses ecosystem analysis and modeling. The diverse faculty has particularly strong backgrounds within the northern hardwood forests, tropical forests, temperate and tropical rivers, lakes and wetland ecosystems. Specific research projects related to systems ecology include the following: nutrient flows in Adirondack ecosystems; changing tree species dynamics related to changing patterns of climate, precipitation chemistry and pathogens; long-term ecological research on disturbance and recovery in the Caribbean National Forest; phosphorus dynamics linking rivers and lakes in both upstate New York and Montana; and procedures for enhancing the recovery from disturbance of ecosystems in both the Adirondacks and in India.

The approach of the Faculty of Environmental Studies to environmental systems science stresses sustainable development as a basic concept, environmental information systems as a means for organizing environmental data, and environmental program analysis as a critical review of environmental policy programs. Current research revolves around international applications of integrated environmental planning, wetland systems assessment and evaluation, cross-cultural environmental perception, and environmental information system utilization and accuracy.

The approach of the Faculty of Forest Engineering to environmental systems science emphasizes hydrology and water resources, including wastewater engineering, and geo-spatial modeling and analysis. Current research activity is focused on remote sensing, digital image measurements, air photo analysis, water quality analysis, modeling and treatment, and solid/hazardous waste systems analysis and treatment.

The Faculty of Forestry stresses resources information management, forest growth modeling and silviculture, forestry economics and policy analysis, and urban greenspace systems ecology. Current research includes studies of forest soil and site productivity, remote sensing and geographic information systems application to forest management, exurban, urban and wildland-urban interface management and silviculture, and the impact of acidic deposition on forest soils.

Polymer Science and Technology

The Polymer Research Institute, a SUNY system-wide polymer research center located in the Faculty of Chemistry, provides the site, resources, and program for scientific research in which graduate students conduct their experimental studies, and the chemistry faculty supervises the graduate education for M.S. and Ph.D. degrees.

Research areas in polymer science available through the institute and supported by GERI include the following: ion-conducting polymers (polymer electrolytes), functionalized polysiloxanes, X-ray contrast polymers, and ring-opening polymerizations of cyclic siloxanes; theoretical studies on elastomers and polymer rubbery state, theory of stress-induced crystallization; new methods of polymer synthesis, stepwise polymerization, synthesis of temperature stable polymers; polymer blends, alloys, and solid phase multicomponent miscible systems; and polymer membranes for gas and liquid separations.

Also under study are the structure, morphology, and dynamics of polysaccharides by diffraction analysis and molecular modeling; use of solid-state NMR methods for studying both the static and dynamic aspects of polymer structure, the interrelation of structure in solid and liquid phases, and the production and characterization of microbial-origin biopolymers; and enzymatic corrosions of biomass to useful products.

Process Engineering

Serving as a bridge between science and technology, process engineering creates practical applications from scientific discoveries, providing the means for converting material resources into useful products. Design, control, and optimization of manufacturing units and systems are key elements of process engineering, while increased attention is given to energy efficiency and waste reduction, and extensive use of computer simulation both in research and practice.

At ESF, activity in process engineering is centered in the Division of Engineering, and is strengthened by long-standing ties with forest products industries through units such as the Empire State Paper Research Institute. However, process engineering relates closely to all of the Faculties and institutes of the College, and links and stimulates the applied aspects of the other three specialties in the GERI program. As this program progresses, ESF aims to become a major center of education and research in process engineering.

Public Service

No one is educated for life — education is a lifelong pursuit. Every year more people find they must return to the classroom for professional upgrading, retraining, and personal enrichment.

In an age where information and technological advancement are replacing industrial goods as the major products, it is more urgent than ever that continuous education, technological transfer, and retraining are made available to everyone.

Since its inception, ESF has held public service as a crucial mission. This mission was reaffirmed and strengthened during the 75th Anniversary of the College in 1986. The College offers a wide variety of learning experiences and reaches out to people with specific learning needs through its Office of Continuing Education.

Serving New York Citizens

The educational needs of New York citizens reflect the trends of our changing times. As research and education lead to an increasingly technological society, our growing sophistication increases concerns about the safety of our environment and the responsible management of our natural resources. As urbanization continues, use and ownership of our agricultural and forested lands leaves traditional hands. As increased leisure time and travel boost our demand for recreational facilities, our land and water suffer under competing uses. As the state strives to balance natural resource utilization with environmental protection, the need grows for people educated in environmental science and forestry.

Continuing Education

The Office of Continuing Education extends the resources and knowledge found at the College to the family of New York. Credit courses, shortcourses, symposia and seminars on subjects related to the ESF curriculum are presented to a wide variety of audiences.

Working in cooperation with government agencies at all levels, professional groups, and representatives of business and industry, the Office of Continuing Education provides opportunities for continuing and professional education by designing courses at the theoretical and applied, basic and advanced levels.

The courses attract participants from both the public and private sectors representing local, regional, national, and international interests. Audiences include environmental consultants and engi-

neers; forest owners, managers, and operators; scientists and researchers; wood and construction engineers; paper products manufacturers and researchers; conservation and recreation personnel; wildlife managers; landscape architects and local and regional planners; and concerned citizens.

The College's continuing education programs include credit or noncredit courses arranged on campus or at off-campus sites, and designed to meet the needs of busy adults by varying in length from hour-long seminars to full-semester graduate level courses.

Community Education

Continuing education also provides personal enrichment for members of the local community. The unique expertise of the College faculty is extended to the community through public shortcourses, lecture series, and forums. Community members are invited to make recommendations for continuing education activities.

Conference Services

The College provides conference services for meetings of professional associations, technical and academic societies, government, industry, environmental, and community organizations, and other groups whose interests correspond with the mission of the College. The Office of Continuing Education has coordinated programs ranging from small seminars to week-long international meetings at locations ranging from urban campuses, conference centers and hotels to rustic retreats.

The College can provide meeting facilities for groups of up to 450. Through its ties with Syracuse University and area hotel convention sites, groups of 2,000 or more can be accommodated. Depending upon availability, a complete range of conference services from meeting rooms and audio-visual services to lodging and catering is available.

The College's regional campuses — in the Adirondacks at Wanakena, Newcomb and Warrensburg, and in western New York at Allegany State Park — are also attractive sites for conferences. Inquiries about facilities, services, and costs are invited.

Nonmatriculated Students

Most of the credit courses offered at ESF are available to students not enrolled in a degree program. By registering through the Office of Continuing Education, a student may develop additional expertise in a professional area, earn credit applicable toward a college degree, develop the prerequisites necessary to enter more advanced courses at ESF or elsewhere, or sample courses as an aid to determining a future major or career.

Other Public Services

The College, throughout its history, has continued to respond to its specific legislative mission in the area of public service. The principal formal public service activities include community education and information, technical advice and guidance to local, state, and federal agencies and organizations, and technical assistance to the forest and wood-using industries.

The complete list of ESF's public service contributions is lengthy, but two examples are the Tree Pest and Disease Service, which provides technical advice to private citizens and to governmental agencies, and the participation of faculty in Central New York's Poison Control Center. Altogether, the College's public service programs reach approximately 1 million New York residents each year.

Admissions

Undergraduate Admissions

The College is well known for the high quality of its undergraduate instruction and unique teaching facilities, and admits well-qualified students at the freshman, sophomore, and junior levels. Several factors are considered before students are accepted for admissions at any level. These factors include their academic preparation, personal motivation, chosen major, and reasons for wanting to study at ESF.

Applying for Admission

Students admitted to the College can be divided into three groups:

1. Freshman admission (regular or early decision);
2. Guaranteed transfer admission;
3. Transfer admission.

Each entrance category requires the applicant to have a specific academic background, and to have maintained satisfactory academic progress at their previous educational institution.

Application forms for admission to the College are available through all New York State high schools, and other SUNY admissions offices. An application package may also be obtained directly from the ESF Office of Undergraduate Admissions.

Freshman Admission

The College enrolls a limited number of students directly from high school. This freshman enrollment option is available for students who meet the selective admissions standards, and choose one of the following majors:

1. Chemistry;
2. Environmental and forest biology;
3. Forest engineering;
4. Paper science and engineering;
5. Resources management (general forestry);
6. The dual option (combining biology and forestry).

Successful freshman applicants should present outstanding academic credentials from high school. Four units each of college preparatory mathematics and science, including chemistry and/or physics, are required. Applicants are required to forward the results of either the SAT or ACT examination. College Board Achievement tests are not required, but in some cases they may highlight the special talents of an applicant.

Freshman applicants are also required to write an essay. The writing sample must be submitted on a supplemental admission form which may be obtained from the Office of Undergraduate Admissions, and is to be returned directly to that office. In addition, freshman applicants are encouraged to participate in either our fall open house program or a freshman information session to improve their understanding of the College and its academic programs.

Since ESF cannot offer admission to all freshman applicants, it reserves the right to offer guaranteed transfer admission to students who are not qualified to enroll directly after high school. These applicants are offered a guarantee of admission to ESF for either their sophomore or junior year of college under the condition they satisfactorily complete the lower division requirements for their program of study during their freshman year or freshman and sophomore years at another college. Please refer to the following section for more information

Application Filing Dates

	Enrollment Option	Filing Deadlines
Freshman:	Fall enrollment, early decision	November 15
	Fall enrollment, regular admission	March 1*
Transfer:	Fall enrollment	May 1*
	Spring enrollment	December 1*

Prospective students are strongly urged to submit their applications earlier than the recommended date to reduce the possibility they will be placed on an admissions waiting list.

*Applications received after these dates will be considered on a space available basis.

on the guaranteed transfer admission program.

Applicants for freshman admission who are sure that ESF is their first choice should apply under the **early decision option**. Early decision candidates must have a **completed** application on file by November 15. This must include the supplemental admissions form obtained from the Admissions Office, results of either an SAT or ACT examination, an essay, and the State University of New York application.

All early decision candidates will be notified of the admission's committee decision by December 15. Those students accepted under early decision and who have a completed financial aid application on file will be notified of their preliminary financial aid package by January 15. Under this enrollment option, accepted candidates must agree to withdraw their applications from other colleges once they receive their financial aid package from ESF. Students not admitted through the early decision option will be considered under regular admission.

Guaranteed Transfer Admission

The College also recognizes that some students have made arrangements to spend some portion of their first two years of college at other institutions, and will transfer to ESF in either their sophomore or junior year. To facilitate this process and reduce difficulties associated with transferring, ESF has established a guaranteed transfer admission (GTA) option.

Under this option, students are guaranteed admission to ESF for either their sophomore or junior year. These students benefit from long-term academic advising to ensure they meet all academic requirements for transferring to the College. Students accepted under the GTA option also receive special mailings and invitations to participate in activities on the ESF campus. They must satisfactorily complete with a minimum cumulative grade point average of 2.000 (A=4.000) the lower division requirements of their program of study.

High school seniors who would like to enroll in environmental studies, landscape architecture, or wood products engineering, in particular, are encouraged to apply to the College under the GTA option to assure their enrollment at ESF for their junior year of college.

Transfer Admission

The largest number of students who enroll at the College transfer to ESF after spending one or two years at another college.

Unless they receive guaranteed admission under the standards of the GTA option, transfer students' admissibility is based primarily on the quality and distribution of their previous coursework in meeting the lower division requirements of their intended program of study, overall academic performance, and specific interest in ESF programs. Consideration is given to both the quality and appropriateness of the students' prior academic experience, and for most programs a significant emphasis is placed on the students' background in mathematics and science.

Students who apply to ESF are expected to have followed the prescribed set of prerequisite courses appropriate to their intended major at the College. Each Faculty of the College has defined the required courses necessary to be considered for admission to its programs. Please refer to the Academic Programs of this Catalog for further information. To be considered for admission to ESF, a transfer student must have a minimum grade point average of 2.000 (A=4.000) at the last institution where the student was enrolled full time.

For transfer students, it is expected that courses taken at other colleges will be completed at institutions that are accredited by one of six regional accrediting agencies. These are the Middle States Association of Colleges and Schools, New England Association of Schools and Colleges, North Central Association of Colleges and Schools, Northwest Association of Schools and Colleges, Southern Association of Colleges and Schools, and Western Association of Schools and Colleges.

Forest Technology Admission

The New York State Ranger School does not enroll freshmen. Candidates may apply for acceptance into the forest technology program either under the guaranteed transfer admission option or as a transfer student.

High school students who wish to enroll in this program should apply during their senior year to receive a guarantee of an entry date one year later. For example, high school students in the class of 1993 should apply during their senior year for admission to the Ranger School in 1994. For further information on the New York State Ranger School, see page 101 or contact the ESF Office of Undergraduate Admissions.

Deferred Admissions

Students accepted to ESF who wish to defer their enrollment for one or two semesters beyond their original entry date must make this request in writing directly to the Office of Undergraduate Admissions. Those students will receive written notification if their request has been approved. A $100 non-refundable advance deposit fee is required for deferred enrollment, and will be applied to future tuition charges.

Campus Visits

The College welcomes visitors to its campuses. High school students should contact the Office of Undergraduate Admissions to schedule participation in a Freshman In-

Enrollment Options

ESF Major	Freshman	Sophomore	Junior
Bachelor of Science			
Environmental and forest biology	X		X
Resources management (forestry)	X		X
Dual (biology and forestry)	X	X	X
Chemistry	X	X	X
Paper science and engineering	X	X	X
Forest engineering	X	X	X
Wood products engineering			X
Environmental studies			X
Bachelor of Landscape Architecture			
Landscape architecture			X
Associate in Applied Science			
Forest technology		X	

formation Session. Prospective transfer students who wish to visit the Syracuse campus, meet with a member of the admissions staff, take a campus tour, or possibly meet with a member of the faculty are asked to make an appointment through the Office of Undergraduate Admissions. Admissions staff are available for appointments from Monday through Friday between 9 a.m. and 3 p.m., while tours led by ESF students are provided by the admissions office most weekdays at 10 a.m. and 2 p.m. Students interested in visiting the New York State Ranger School should make arrangements directly with that campus.

Cooperative Transfer Programs

The College has developed pre-environmental science and forestry transfer programs with 59 other colleges both in and out of New York State. These programs offer high school students a wide selection of colleges from which they can obtain the necessary lower division courses, and appropriate advice on how to prepare for ESF.

These institutions represent a broad spectrum of higher education, including private, public, two- and four-year colleges in Alabama, Connecticut, Maryland, Massachusetts, New Jersey, Pennsylvania, and Rhode Island, as well as New York. Students who attend these colleges and follow a program prescribed by ESF will share a common academic background with other students who transfer to the College.

The cooperative colleges are the following:

New York State Colleges

Adirondack Community College, Glens Falls
Broome County Community College, Binghamton
Canisius College, Buffalo
Cayuga County Community College, Auburn
Clinton County Community College, Plattsburgh
Columbia-Greene Community College, Hudson
Community College of the Finger Lakes, Canandaigua
Corning Community College, Corning
Dutchess County Community College, Poughkeepsie
Erie County Community College, Buffalo
Herbert H. Lehman College, the Bronx
Herkimer County Community College, Herkimer

Hudson Valley Community College, Troy
Jamestown Community College, Jamestown
Jefferson County Community College, Watertown
Kingsborough Community College, Brooklyn
Le Moyne College, Syracuse
Mohawk Valley Community College, Utica
Monroe County Community College, Rochester
Nassau County Community College, Garden City
Niagara County Community College, Sanborn
North Country Community College, Saranac Lake
Onondaga County Community College, Syracuse
Orange County Community College, Middletown
Paul Smith's College, Paul Smith's
Rockland County Community College, Suffern
St. John Fisher College, Rochester
Siena College, Loudonville
Suffolk County Community College, Selden
Sullivan County Community College, Loch Sheldrake
SUNY College of Technology at Alfred
SUNY College of Technology at Canton
SUNY College of Agriculture and Technology at Cobleskill
SUNY College at Cortland
SUNY College of Technology at Delhi
SUNY College at Geneseo
SUNY College of Agriculture and Technology at Morrisville
SUNY College at New Paltz
SUNY College at Oneonta
SUNY College at Oswego
Syracuse University
Tompkins-Cortland Community College, Dryden
Ulster County Community College, Stone Ridge
Westchester County Community College, Valhalla

Out-of-State Colleges

Allegany County Community College, Cumberland, MD
Berkshire Community College, Pittsfield, MA
Bishop State College, Mobile, AL
Camden County College, Blackwood, NJ
Garrett Community College, McHenry, MD
Holyoke Community College, Holyoke, MA
Housatonic Community College, Bridgeport, CT
Keystone Junior College, LaPlume, PA
Middlesex County Community College, Edison, NJ
Montgomery County Community College, Rockville, MD
Northampton Community College, Bethlehem, PA
Ocean County College, Toms River, NJ
Roger Williams College, Bristol, RI
Tuskegee University, Tuskegee, AL
Union College, Cranford, NJ

Transfer Credit

Credit hours appropriate to the ESF curriculum can be transferred to the College, but grades and grade points cannot be transferred. Courses to be transferred to meet graduation requirements for any curriculum must be acceptable in content, and credit will be awarded only for those completed with a grade of "C" or higher.

All transfer credit will remain tentative until official, final transcripts are received and reviewed by Office of Undergraduate Admissions staff. **It is the student's responsibility to ensure that official, final transcripts are sent to and received by the College.**

College Credit By Examination

The College will consider for advanced standing credit the results of examinations from standardized testing agencies such as the College Entrance Examination Board's Advanced Placement (AP) or College Level Examination Programs (CLEP).

For freshman applicants, any AP examination score of 3 or higher or any CLEP examination in the 50th percentile or higher will be considered for credit. For transfer students, ESF will generally accept the same credit as was granted by the transferring college for AP and CLEP results. Further information is available from the Office of Undergraduate Admissions.

Educational Opportunity Program

The State University of New York recognizes that providing access to an educational opportunity for all state residents means being sensitive to the educational needs of people with varying social, cultural, educational, and economic backgrounds.

The Educational Opportunity Program (EOP) is an academic and financial support program offered at ESF and other SUNY campuses to provide a college education for capable students who have not had the same opportunities as other students to realize their academic potential because of limited financial resources and inadequate academic preparation. The program is not designed for students who need only financial assistance.

The basic goal of the EOP program at the College is to provide qualified students with a college education and the opportunity for personal growth and professional development. Counseling, financial assistance, and tutoring are provided on an individual basis.

To qualify, students must be New York State residents and demonstrate the potential to successfully complete a course of study at the College.

High school seniors who want to apply for freshman enrollment and EOP status at the College must file a SUNY application form with their high school guidance coun-

selor, and indicate they want to be considered for EOP. In addition, they must file a Family Financial Statement directly to the Financial Aid Office at ESF.

In order for transfer students to participate in the program at the College, they must have been enrolled in an EOP, Higher Education Opportunity Program (HEOP) or Search for Education Elevation and Knowledge (SEEK) program at their prior college. Therefore, students who are applying to ESF as high school seniors through the advanced early admission option, should also apply for EOP, HEOP or SEEK at their lower division college, and must enroll in such a program in order to continue in EOP at ESF.

For further information, contact the Director of the Educational Opportunity Program at the College.

Medical Examination

Each new student is required to submit a medical history and physical examination report on a form that will be sent to the student after the initial acceptance notice.

Graduate Admissions

Admission into a program of graduate study requires the review and acceptance of an applicant's credentials by appropriate faculty members, and the recommendation of the appropriate Faculty Chair to the Dean of Instruction and Graduate Studies.

Minimum requirements are a bachelor's degree from a recognized institution, and in most cases an academic record showing at least a "B" average for junior and senior years of the baccalaureate program or for the master's program.

Also required are Graduate Record Examination (GRE) scores, and for some degree programs advanced test scores, supporting letters of recommendation, and a statement of educational and professional goals. The GRE scores may be waived by a Faculty on an individual basis.

A non-refundable $35 application fee is charged.

GRE Advanced Tests

Subject matter advanced tests are required by the following programs:

Graduate Program	*Advanced Test*
Chemistry	Chemistry
Chemistry (biochemistry area of study)	Chemistry or Biology
Environmental and forest biology	Biology

Procedure

The College provides an application form for graduate admissions. Requests for information and applications should be addressed to the Office of Instruction and Graduate Studies.

The GRE and Test of English as a Foreign Language (TOEFL) examinations are offered several times each year in major cities of the world. For information on the examinations, write to the Educational Testing Service, Princeton, New Jersey 08540. In submitting test scores to the College (**institutional number R2530**), request they be sent to the Office of Instruction and Graduate Studies.

International Students

The College enrolls international students on the undergraduate and graduate levels if they satisfy the admission requirements outlined throughout this section of the Catalog.

In addition to the requirements that all prospective students must meet, international students must provide evidence of the following:

1). Proficiency in the English language through acceptable performance on either the Test of English as a Foreign Language (TOEFL) or the College Entrance Board Achievement Test in English (scores of 550 or higher on either test are required), or by completing at least two years of college at an institution where the courses were taught in English;

2). Ability to meet all of the financial obligations which will be incurred while attending the College.

International students must also file the State University of New York Foreign Student Admission forms. No fee is required for processing these forms.

If accepted for enrollment, health and accident insurance supplied by the State University of New York must be obtained before the student will be allowed to register at the College. Further details about this policy are available from Syracuse University International Student Office, 310 Walnut Place, (315) 443-2457, or from the ESF Office of Student Affairs and Educational Services.

International students who are currently enrolled at an American college may apply for admission to ESF. In addition to the entrance requirements for other international students, they must obtain permission to transfer to ESF from the U.S. Immigration and Naturalization Service district office having jurisdiction over the college in which they are currently enrolled.

International students will be considered for assistantships and fellowships, but are not eligible for need-based student financial assistance.

Expenses

The ESF tuition and College fee structure is set by the State University of New York Board of Trustees, and generally covers the costs associated with instruction and the use of facilities and services at the College.

Tuition

The tuition schedule per semester, listed below, is subject to change:

	NYS Resident Students	Out-of-State Students
Undergraduate Matriculated		
Full-time	$1,325	$3,275
Part-time	$105/credit hour	$274/credit hour
Graduate Matriculated		
Full-time	$2,000	$3,658
Part-time	$168/credit hour	$308/credit hour
Continuing Education Non-Degree Students without a Baccalaureate Degree		
Course Nos. 0-599	$105/credit hour	$274/credit hour
Course Nos. 600-999	$168/credit hour	$308/credit hour
Students with a Baccalaureate Degree		
Course Nos. 0-499	$105/credit hour	$274/credit hour
Course Nos.500-999	$168/credit hour	$308/credit hour
Maximum Total Tuition for 12 credit hours or more:		
Undergraduate	$1,325	$3,275
Graduate	$2,000	$3,658

Residency

For purposes of tuition, "residence" refers to the principal or permanent home to which the student returns. Students who want to change their permanent residence may apply for a change in residency after they enroll at the College. Application forms are available in the Bursar's Office.

Fees

Application

Students who apply for admission to an undergraduate program at any of the State University of New York units are charged a nonrefundable application fee of $25. For more information about the fee, and guidelines for exemptions, obtain the Application Guidebook for the State University of New York through any SUNY admissions office or any New York State high school.

Students who apply for admission to a graduate program at ESF are charged a nonrefundable application fee of $35.

College

The College fee is $12.50 per semester for full-time students, and 85 cents per credit hour for part-time students. For tuition purposes, students are considered full-time when they are enrolled in 12 credit hours or more.

Student Activities

Each full-time undergraduate student is charged $60 per year to cover the cost of student activities at

the College, while full-time non-matriculated students are charged $30 per semester, and part-time matriculated students are charged $1.50 per credit hour.

Full-time graduate students are charged an activity fee of $28 in the fall only. Part-time matriculated graduate students are charged $7 per semester. Full-time graduate students who enter ESF in the spring semester are charged a $7.50 student activities fee.

Students also pay an annual fee to Syracuse University to cover university-sponsored activities and services that are available to ESF students, but not duplicated at the College. These fees are $26.75 for full-time undergraduate students and $15 for full-time graduate students, and are charged in the fall only.

Part-time matriculated undergraduate students are charged $17.50 per year and part-time matriculated graduate students are charged $10 per year at fall registration only.

Syracuse University does not charge an activities fee for non-matriculated undergraduate or graduate students.

Orientation Program

New undergraduate students will be charged a fee which covers the cost of a College Orientation Program. This is a voluntary activity and students who choose not to attend may request refund of the $35 fee.

Student Support Services

All full-time students are charged $87.50 per semester to partially offset the cost of academic and other support services provided by Syracuse University, while part-time students are charged $7.50 per credit hour.

Final Year

A commencement fee of $14 is required at the beginning of the semester in which a student is expected to obtain a degree.

All undergraduates are also charged $15 for a school yearbook in the spring semester, and a $10 senior gift charge the semester they are expected to graduate.

Additional costs are incurred by graduate students for the binding, abstracting, and microfilming of theses, projects, and reports of professional experience.

International Student Health Insurance

All international students attending the College must participate in the State University of New York International Health Insurance Program. The cost is estimated to be $471 per calendar year. Coverage for dependents is available from the insurance carrier.

Terms of Payment

Undergraduate Deposit

All undergraduate students pay an advance payment deposit of up to $100 after they are admitted to the College. Information on when the deposit is due, as well as refund guidelines for the deposit, are sent to students after they accept an offer of admission. The deposit is credited to the students' first semester tuition. There is no advance payment deposit required for students accepted for graduate study.

Billing

Six weeks prior to the start of each semester, the College sends students who have registered for the upcoming semester a detailed invoice indicating the total amounts they are expected to be charged. This invoice includes only ESF charges. (See below for housing and board costs at Syracuse University). Payment is due before the first day of classes. New students will be billed upon arrival and payment will be due in 15 days. Detailed instructions are included with the invoice.

The College participates in deferred tuition payment plans, including Academic Management Services, Tuition Management Systems, and The Tuition Plan. The purpose of these plans is to allow students or parents to make tuition payments in monthly installments.

Refunds

A student who is given permission to cancel registration is liable for payment of tuition in accordance with the following schedule:

Liability During Semester	
1st week:	0%
2nd week:	30%
3rd week:	50%
4th week:	70%
5th week:	100%

Application for a refund must be made within one year after the end of the semester for which the tuition was paid to the College. The first day that classes are offered, as scheduled by the College, shall be considered the first day of the semester, and the first week of classes for purposes of refunds shall be deemed to have ended when seven calendar days, including the first day of scheduled classes, has elapsed.

There is no tuition or fee liability established for a student who withdraws to enter military service prior to the end of a semester for those courses for which the student does not receive academic credit.

A student who is dismissed for academic or disciplinary reasons prior to the end of a semester is liable for all tuition and fees due for that semester.

A student who cancels registration at a unit of the State University of New York, and within the same semester registers at another unit of the state system is entitled to full credit for tuition and fees paid for that semester.

In situations where a student must withdraw from the College under circumstances in which the denial of a refund would create serious hardship, the bursar can waive the normal refund schedule. Such action can be taken if the student has completed no more than one-half of the semester and will not receive academic credit for the semester. A written request for relief from the provisions of the refund schedule, including the reasons for the student's withdrawal, must be submitted to the bursar.

Other Costs

Room and Board Costs

The College does not operate student residence or dining halls, but facilities are available at Syracuse University.

In general, housing costs at Syracuse University range from $1,325 to $1,695 per semester, reflecting the diversity of single- and multiple-room accommodations for graduate, undergraduate, single, and married students.

A variety of meal plan options are also available to all students, whether or not they reside in university residence halls. The costs of these plans range from $500 to $1,480 per semester. Payment for housing and meal plans is made directly to Syracuse University.

For more information about housing and meal options refer to the Student Life section of this catalog, and/or contact the Office of Residence Services, 202 Steele Hall, Syracuse University, Syracuse, New York 13244, (315) 443-2721.

Program Expenses

The cost of books and supplies is approximately $600 per year. Additional costs for personal expenses, clothing, and transportation vary greatly from student to student, but are estimated to range from $900 to $1,100 per year.

Several programs at ESF include additional costs. Students majoring in resources management attend a seven-week Summer Session in Field Forestry at the Wanakena Campus between the sophomore and junior years. Environmental and forest biology majors attend the summer field experience at the Cranberry Lake Biological Station at the end of their junior year.

The Summer Session in Field Forestry costs approximately $1,375, while the five-week program at Cranberry Lake costs between $932 and $2,232, plus travel and personal expenses.

Wood products engineering students take an extended field trip of up to two weeks at the end of their junior year at a cost of approximately $250.

Field trips for landscape architecture students range between $150 and $300. In addition, students enrolled in landscape architecture are required to spend one semester off campus. This is a self-designed and student-budgeted program. Costs do not necessarily exceed those of a semester on campus, but additional costs are often incurred depending upon the location chosen. These additional costs are the responsibility of the student, and are not covered by financial aid.

Forest Technology Program

Please see page 104 for detailed expenses for the Forest Technology Program on the Wanakena campus.

Financial Aid

The College offers these seven basic forms of student financial assistance: scholarships or grants; part-time employment; long-term loans; minority student scholarships and fellowships; assistantships, tuition scholarships, and fellowships for graduate students; a deferred tuition payment plan; and sources of non-need loans to parents.

Federal and state financial aid programs are for United States citizens, permanent residents, or holders of I-151 cards. (International students will be considered for assistantships and fellowships, but are not eligible for need-based student financial assistance.) These programs are coordinated to supplement parental support, summer work, savings, and assistance from other sources. The sources of funds for financial assistance programs, the guidelines for determining the recipients, the procedures for applying, and the method of disbursement of funds vary from one program to another. This information is presented in detail in Financial Assistance at ESF, which is a separate publication that is mailed to all applicants and is available through the Office of Financial Aid.

Most financial aid is awarded primarily on the basis of financial need. Some scholarships and fellowships, however, are based on other criteria, such as academic achievement or minority status. Assistantships, tuition scholarships, and fellowships for graduate students are not awarded based upon financial need.

In order for students to receive aid, they must be making satisfactory academic progress toward a degree. Please refer to pages 24 and 25.

Financial aid advisors are aware of the many problems of financing higher education and meeting day-to-day living expenses for both undergraduate and graduate students, and are available to discuss individual problems. All students are encouraged to apply for financial aid.

How to Apply

Students interested in receiving financial assistance, with the exception of graduate assistantships, tuition scholarships, and fellowships, must complete an application process each year that requires the filing of at least two forms. (See Graduate Assistantships below).

1. After January 1, students must complete the Family Financial Statement (FFS), and submit it to the American College Testing Company, Iowa City, Iowa 52243.

2. Students must also complete a College Aid Application and Financial Aid Transcript, and return it to the Office of Financial Aid by February 15 for early consideration or March 15 for regular consideration.

Applications will be accepted after March 15, but available funds may already be committed to other students. Prospective students do not need to receive notification of acceptance to ESF before applying for financial aid, however, they must be accepted to the College before a financial aid decision is rendered.

The necessary forms are available in the Office of Financial Aid, high school guidance offices, and many college financial aid offices. The College Aid Application and Financial Aid Transcript is also included in Financial Assistance at ESF.

Students are invited to discuss with the Financial Aid Office staff any problems they may have in financing their education. Applicants are also urged to contact the office for the latest information and requirements pertaining to financial assistance, because financial aid systems and forms frequently change.

Selection of Recipients

The primary consideration in determining which students will receive awards is comparative financial need. However, scholastic standing, citizenship, and potential contribution to the College community are also considered in making certain award decisions.

Verification of Information

All students who request financial assistance will be required to submit information about their family's and/or personal financial situation prior to aid disbursement. The College will request copies of parents' and/or students' federal tax forms, along with other statements which will be used to verify other sources of income, family size, number of dependents in college, and other pertinent information.

Failure to comply with a request to verify pertinent information will result in the cancellation of any aid offered, and the possibility of legal action being taken by the U.S. Department of Education.

Retention of State Awards

All students who are awarded financial assistance will be required to maintain satisfactory academic progress each semester in order to keep their awards. Academic progress standards for all awards provided by New York State are listed below.

Recipients of a New York State award must adhere to the following state requirements:

1. Academic Progress — Students must meet the stated minimums on the following charts to be eligible for an award the next semester.

2. Program Pursuit — Students must complete a minimum number of credit hours each semester based on a full-time course load of 12 credit hours.

a. Associate in Applied Science degree students are required to complete 75 percent of the full-time credit load. Therefore, they must receive at least nine credits per semester. (.75 x 12 = 9).

b. Bachelor degree students must complete 100 percent of a full-time credit load each semester. Therefore, they must complete 12 credit hours each semester.

c. Graduate degree students must complete 100 percent of a full-time course load, or 12 credits, unless they have an assistantship. Graduate students with an assistantship should see the section on Credit Hour Load in the Graduate Academic Policies section of this Catalog for the definition of full-time status.

Waivers for New York Awards

Students who fall below the credit requirement may apply for a waiver. Students are allowed only one waiver during undergraduate work, and only one waiver during graduate work. A waiver will be granted only after the student and College officials agree that such an issuance is in the best interest of the student. Requests for waivers are made through the Director of Financial Aid.

Standard of Satisfactory Academic Progress for Purpose of Determining Eligibility for State Student Aid

Calendar: Semester — Programs: Associate Degrees

Before being certified for this payment,	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
a student must have accrued at least this many credits	0	3	9	18	30	45	60	75
with at least this grade point average	.000	.500	.750	1.300	1.500	1.700	2.000	2.000

Noncredit remedial instruction can be counted toward a full-time academic load as set forth in 145-2.1 of the Commissioner's Regulations. The number of credits in this chart refers to work completed toward the degree.

Calendar: Semester				Program: Baccalaureate Degree						
Before being certified for this payment	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Tenth
a student must have accrued at least this many credits,	0	3	9	18	30	45	60	75	90	105
with at least this grade point average	.000	.500	.750	1.200	1.400	1.500	1.600	1.700	1.800	1.900

Noncredit remedial instruction can be counted toward a full-time academic load as set forth in 145-2.1 of the Commissioner's Regulations. The number of credits in this chart refers to work completed toward the degree.

Calendar: Semester				Program: All Graduate Level Programs				
Before being certified for this payment	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
a student must have accrued at least this many credits,	0	6	12	21	30	45	60	75
with at least this grade point average.	.000	2.000	2.500	2.750	3.000	3.000	3.000	3.000

Retention of Federal Awards

Undergraduate and graduate students must meet specified criteria in order to be eligible for Title IV Federal Student Assistance, which includes Pell Grants, Supplemental Educational Opportunity Grants, Perkins Student Loans, Stafford Loans, College Work-Study Programs, and Parent Loan for Undergraduate Students.

The criteria that students must meet to be eligible for Title IV student aid are the same criteria all ESF students must adhere to in terms of institutional academic policies, and specifically academic progress towards a degree.

The evaluation criteria are the following:

1. An appropriate grade point average to ensure satisfactory academic progress;
2. The successful accumulation of credits toward a degree;
3. Receiving a degree within the prescribed time limit for that program. (Limits vary for individual programs: see following tables).

Standard of Satisfactory Academic Progress for Purpose of Determining Eligibility for Federal Aid

Calendar: Academic Year **Program: Associate Degree**

Academic years completed at ESF	2	3
A student must have successfully completed this number of credit hours	45	76
with at least this cumulative grade point average	2.000	2.000

Calendar: Academic Year **Program: Baccalaureate Degree**

Academic years completed at ESF	1	2	3	4	5	6
A student must have successfully completed this number of credit hours	10	40	70	100	130	160
with at least this cumulative grade point average	2.000	2.000	2.000	2.000	2.000	2.000

Calendar: Academic Year **Program: All Master Level Programs**

Academic year completed at ESF	1	2	3
A student must have successfully completed this number of credit hours	15	27	42
with at least this cumulative grade point average	3.000	3.000	3.000

Calendar: Academic Year	Program: All Ph.D. Level Programs						
Academic year completed at ESF	1	2	3	4	5	6	7
A student must have successfully completed this number of credit hours	15	27	42	54	66	75	90
with at least this cumulative grade point average	3.000	3.000	3.000	3.000	3.000	3.000	3.000

Appeal, Probation, Reinstatement

Students who fall below the minimum standards may appeal to the Dean of Instruction and Graduate Studies to retain their academic eligibility to receive Title IV Federal Student Assistance. (See Academic Dismissal, page 32).

Appeals will be evaluated for mitigating circumstances such as injury or illness, and the likelihood that the student will be able to return to the appropriate standard. If the Dean of Instruction and Graduate Studies places a student on "academic probation," the student remains eligible for Title IV aid as defined by the statement of "Good Academic Standing." (See page 39).

The Office of Financial Aid will notify students via certified mail if they are in danger of losing financial assistance because they have fallen below academic standards.

Scholarship, Fellowship and Grant Programs

Supplemental Educational Opportunity Grants

The College receives Supplemental Educational Opportunity Grants (SEOG) authorized under Title IV-A of the Higher Education Act of 1965. These funds enable the College to award grants to undergraduate students who have financial need. Grants range from $100 to $4,000 per year.

Educational Opportunity Program

Students accepted into the College's Educational Opportunity Program (EOP) may receive, in addition to other financial assistance, a special award to pay for education-related costs. Students must come from a socio-economically and academically disadvantaged background to be eligible.

Prospective EOP students must apply for financial aid when submitting their admissions applications.

Pell Grants

The Pell Program, formerly known as Basic Educational Opportunity Grants, was authorized in the Educational Amendments of 1972. Grants are available to eligible full-time and part-time undergraduate students, and can vary from $250 to $2,400.

Applications are available from high school guidance offices or any college office of financial aid. Interested students should submit the Student Aid Report (SAR) to the Office of Financial Aid as soon as it is received from the processor.

Tuition Assistance Program and Regents Programs

Tuition Assistance Program (TAP) awards are available to New York State residents who are enrolled in full-time degree programs. The awards are based on income, and range from $100 to full tuition.

Regents Grants or Children of Deceased or Disabled Veterans Grants are awarded to children of parents who served during specific periods of war or national emergency, and who died as a result of such service or suffered a disability of at least 50 percent. The awards entitle state residents who qualify to $450 per year.

Additional information and applications for these programs are available from the Office of Financial Aid, or from New York Higher Education Services Corporation, Tower Building, Empire State Plaza, Albany, New York 12255.

Vocational Rehabilitation Grants

Financial assistance and program counseling are provided by New York State for students with disabling conditions. Information is available from

any state Office of Vocational Rehabilitation.

Veterans' Benefits

The Veterans' Readjustment Benefits Act of 1966, as amended, enables veterans and children of deceased or disabled veterans to obtain financial aid for their college education.

Application forms and additional information and counseling are available from the ESF Veterans' Affairs Counselor in the Office of the Registrar, local veterans' administrations offices, and the State Regional Office, 111 West Huron Street, Buffalo, New York 14202.

Minority Student Scholarships and Fellowships

Undergraduates who are New York State residents who are Black/ Non-Hispanic, Hispanic, Native American, or Alaskan Native are eligible for scholarships comprised of funds from both the College and SUNY. Eligible students should contact the Office of Financial Aid.

Graduate students who are Black/ Non-Hispanic, Hispanic, Native American, or Alaskan Native and are also U.S. citizens or permanent residents are eligible for SUNY Underrepresented Minority Graduate Fellowships. Eligible students should contact the Office of the Dean of Instruction and Graduate Studies.

Assistance for Native American Students

Native American students with financial need may be eligible for scholarship and grant assistance through programs sponsored by the Federal Bureau of Indian Affairs and the New York State Education Department. For more information, students should contact the Bureau of Indian Affairs, 1951 Constitution Avenue NW, Washington, D.C., or the Native American Education Unit, State Education Department, Education Building Annex, Albany, New York 12234.

Private Fellowships, Scholarships, and Grants

The College administers a number of financial aid programs established by private individuals, companies, organizations, and foundations. These scholarships and grant programs have varying eligibility requirements and are awarded to students according to their respective guidelines, which are described in more detail in Financial Assistance at ESF.

The following is a list of the programs: Maurice Alexander Wetland Research Award, Alumni Educational Grants, Alumni Memorial Awards, Warren Bennett Memorial Award, John Berglund Memorial Scholarship, Simeon H. Bornt III Scholarship Award, Nelson Courtlandt Brown Scholarship Fund, Henry H. Buckley Student Aid Award, John Clark Scholarship, Class of '31 Scholarship, William Cross Memorial Scholarship, Edward Czycon Scholarship, Wilford A. Dence Memorial Award, Morris Hirsch Scholarship, Meyer Environmental Chemistry Scholarship Award, Meyer Wood-Plastic Scholarship Award, Onondaga Anglers' Association Scholarship, Portia Farrell Morgan Scholarship, Ranger School Alumni Scholarship, Eugene C. Reichard Scholarship Award, Ray Rizzo Scholarship, Phyllis Roskin Memorial Award, Saratoga Association Scholarship, Lt. Gary Scott Memorial Scholarship, Student Association Grants, Walter Tarbox Memorial Scholarship, John J. View Scholarship, Wildfowlers Association of Central New York Scholarship, Gerald H. Williams Scholarship, and the Phillip Zipf Scholarship.

Syracuse Pulp and Paper Foundation Scholarships

Scholarships from the Syracuse Pulp and Paper Foundation, Incorporated, are awarded to United States citizens who are undergraduate students in paper science and engineering, and have at least a 2.500 grade point average (4.000 = A). The scholarship may amount to the recipient's annual tuition charge. Students entering the program should ask the Office of Financial Aid for a Pulp and Paper Scholarship application form, and reapply each year for the scholarship.

State University Supplemental Tuition Assistance

The College annually awards small grants to a limited number of students with financial need as part of the State University Supplemental Tuition Assistance program.

Employment Opportunities

College Work-Study Program

The College participates in the Federal College Work-Study Program, which provides part-time jobs during the academic year and full-time posi-

tions during the summer to students who need financial assistance to attend the College. Wages for these positions begin at above the minimum wage and increase as duties and responsibilities increase. The current wages are $4.50 per hour during the academic year and $6 per hour during the summer.

Job Locator Service

The College coordinates and maintains an active program of part-time and summer employment opportunities. Interested students should contact the Student Employment Coordinator in the Office of Financial Aid for additional information. The program is open to all ESF students seeking employment.

Loans

Perkins Student Loans

Perkins Student Loans, formerly known as National Direct Student Loans, are available to students with financial need who are enrolled at least half-time. Under the program, $4,500 can be borrowed for two years, $9,000 for four years, and a maximum of $18,000 can be borrowed, including funds for graduate study. A repayment plan, including 5 percent interest, begins nine months after the student leaves college. Deferment and cancellation benefits are available in certain situations. The average loan per student totaled $1,840 in 1991-92.

Stafford Student Loans

The Stafford Student Loan program, formerly Guaranteed Student Loans, is administered by the New York Higher Education Services Corporation for New York State residents.

These loans are available from a bank or other lending agent to students who are registered at least half-time. Undergraduates can borrow an aggregate of $17,250 for their undergraduate studies, while graduate students can borrow an aggregate of $54,750. A repayment plan, including 8 percent interest, begins six months after the student leaves college. An additional 1 percent interest is charged at the time the loan is received. Applications are available at local banks. The average Stafford Student Loan was $3,322 in 1991-92.

Parent Loan for Undergraduate Students

Parents of undergraduate students may borrow from local lending institutions up to $4,000 annually and $20,000 overall at an interest rate of 9.34 percent with a Parent Loan for Undergraduate Students (PLUS). A repayment plan begins 60 days after receipt of the loan, which cannot exceed the total cost of the student's education. Applications for PLUS loans are available at local lending institutions.

Supplemental Loan to Students

Supplemental Student Loans are available for graduate, or independent undergraduate students who want to borrow more than their Stafford Student Loan limit. Eligible students may borrow up to $4,000 per year until they reach a total of $20,000.

Emergency Loans

The College is able to provide some matriculated students interest-free, short-term loans. These 30-day loans are available through the support of the Alumni Association Short-term Loan Fund, the David B. Schorer Memorial Fund, and the Edward Vail Emergency Fund. For more information, contact the Office of Financial Aid.

Graduate Assistantships and Tuition Scholarships

Assistantships are awarded to students who have demonstrated scholarship and academic promise, and whose education and experience enable them to assist in laboratory instruction and research. The amounts of the assistantships range from $6,800 per academic year to as high as $18,000 for a calendar year. In addition, a tuition scholarship may be awarded. Students who hold an assistantship must be enrolled for full-time study as defined by graduate policies, and be making satisfactory progress toward completing their degree.

Beginning graduate students may apply for assistantships on their application for admission. Continuing graduate students should consult with their major professors.

Academic Policies

Undergraduate Policies

General Requirements

A student seeking a degree must be in matriculated status. All degree requirements must be completed through a combination of formally accepted transfer credits and/or courses taken at ESF and Syracuse University.

While a student is matriculated at ESF, all courses taken at ESF and Syracuse University to meet degree requirements must be graded on a scale of "A-F", and the grades will be computed in the grade point average. As an exception, at the discretion of the instructor, courses numbered 496 and 497 may be graded on a "Satisfactory/Unsatisfactory" basis. This must be announced on the first day of class and would apply to all students enrolled in that course section.

Credit Hour Load

To be classified as full-time, a student must register for at least 12 credit hours during a semester. A student may not register for more than 18 credits during a semester unless permission from the student's advisor is obtained.

Attendance

Students are expected to adhere to the attendance policy stated by each course instructor. Instructors may make attendance part of the course requirement.

Course Numbering System

Courses at ESF are numbered according to the following system:

100-499 Undergraduate courses for which no graduate credit may be given.

500-599 Graduate courses designed ex pressly for areas of specialization in post-baccalaureate programs or in the professional program leading to the bachelor of landscape architecture. Qualified under graduate students may enroll by permis sion of the instructor.

600-699 Graduate courses designed ex pressly for advanced levels of specializa tion. Undergraduate studentswith a cumula tive grade point average of 3.000 or better may enroll in these courses with an approved petition.

700-999 Advanced graduate level courses for which no undergraduate students may register.

Shared resources courses, designated as 400/500 or 400/600, are designed when the topic coverage of both courses is the same. Separate course syllabuses are developed expressly differentiating the requirements and evaluative criteria between the undergraduate course and the graduate course. No type of crosslisting may be offered unless approved by the ESF Faculty.

Physical Education and R.O.T.C.

Physical Education and R.O.T.C. course credits may be used to satisfy elective requirements with the permission of the student's academic advisor.

Audits

Students may informally audit ESF courses with the permission of the course instructor. No record will be maintained of the informal audit nor will any grade be assigned. No fee is required for informal audits.

Students may formally audit courses with the permission of their academic advisor and the course instructor. They may not be used to satisfy any graduation requirements. Formally audited courses will appear on the students' transcripts and will be graded either "SAU" (satisfactory audit) or "UAU" (unsatisfactory audit). The grade will be assigned based on the criteria for audit established by the course instructor. Registration guidelines for audited courses are the same as for courses taken for credit.

Dropping or Adding Courses

Students may add courses with the approval of both their academic advisor and the course instructor and may drop courses with their advisor's approval and notification to the course instructor via an appropriate drop/add form until the last day for program adjustments as listed in the ESF calendar. Courses dropped during this time will not appear on the student's transcript. Courses that begin after the published add date may be added prior to the start of the course. Courses that last for less than one semester may be dropped no later than half way through the course. In either case, the student must submit a completed add-drop form.

Repeating Courses

Students may repeat any course previously taken either to earn a higher grade or because of a previous failure.

For all courses passed with a grade of "D" or better, credit hours carried and grade points earned will be included in the semester and cumulative grade point averages each time the course is completed. However, the credit hours for the course repeated may be counted only once toward meeting graduation requirements.

Courses in which a grade of "F" was assigned may be repeated. Upon completion of the repeated course, the grade earned will be included in the semester and cumulative grade point average, but the original grade of "F" will revert to a grade of "R" on the transcript and will not be included in the grade point average.

Withdrawal from ESF

Students who withdraw on or before the "drop date" for a semester will have their records marked. "Withdrew on (date)." Courses will appear for that semester with the grade of "W."

Students who withdraw after the "drop date" for a semester, but on or before the last class day before the final examination period, will have either "WP" (withdraw passing) or "WF" (withdraw failing) listed after each uncompleted course. Students who do not withdraw on or before the last class day will have a grade of "A-F," "I," or "I/F" assigned by the instructor for each registered course.

Students who withdraw from ESF and in the future wish to return must apply for readmission. Prior to withdrawal from ESF, students must schedule an interview in the Office of Student Affairs and Educational Services.

Curriculum Requirements

The development and administration of course offerings, prerequisites, sequencing, and program requirements are primarily the responsibility of each program Faculty with the approval of the ESF Faculty.

Students must satisfy the requirements for graduation presented in the catalog in effect as of the date they first matriculate at ESF. Students may graduate under the requirements stated in any catalog issued subsequent to the one in effect the date they matriculate, but they may not use a prior catalog.

Students who change majors are required to submit a completed change of curriculum form approved by representatives of both programs and must complete all the requirements of their new major.

Evaluation

For each course completed, one of the following grades will be awarded:

Grade	Definition	Grade Points
A	Excellent	4.000
A -		3.700
B +		3.300
B	Good	3.000
B -		2.700
C+		2.300
C	Passing	2.000
C -		1.700
D	Minimum Passing	1.000
F	Failure	0.000
I/F	Unresolved Incomplete	0.000

In order to receive a bachelor's degree, a student must complete all courses taken as a matriculated student at ESF with a cumulative grade point average of at least 2.000.

Under conditions defined elsewhere, the following grades may be assigned, none of which yield grade points:

Grade	Definition
S	Satisfactory (equal to "C" or better)
U	Unsatisfactory (equal to Below "C")
W	Withdraw
WP	Withdraw Passing
WF	Withdraw Failing
SAU	Audit (Satisfactory)
UAU	Audit (Unsatisfactory)
I	Incomplete
R	Failed course which was repeated

Grade Point Averages

Semester and cumulative averages are computed by dividing the total grade points earned by the total credit hours completed for all courses graded "A-F."

Incomplete Courses

A temporary grade of "I" may be assigned by an instructor only when the student is passing and has nearly completed the course, but because of circumstances beyond the student's control, the work is not completed. The incomplete grade must be resolved prior to the end of the semester following that in which the incomplete was received. At the request

of the student and with a petition approved by the course instructor only, the incomplete may be extended one additional semester. If the incomplete is not resolved by the appropriate deadline, it will be changed to a grade of "I/F."

Academic Honors

President's Honors List

Students who carried 12 or more credits of coursework graded "A-F" and earned a minimum grade point average of 3.000 with no grades of "I" or "F" will be placed on the President's Honors List for that semester.

Graduation Honors

Students will be graduated with the appropriate honor if the following criteria have been met:

A minimum of 30 credits of ESF and Syracuse University courses have been completed as a matriculated, upper-division student.

A cumulative grade point average of: 3.000 - 3.333, *cum laude*; 3.334 - 3.829, *magna cum laude*, 3.830 - 4.000, *summa cum laude*.

Academic Dismissal

Students who earn less than a 2.000 cumulative grade point average shall have their records reviewed by the Faculty Subcommittee on Academic Standards. Based on this review, the Subcommittee shall recommend to the Dean of Instruction and Graduate Studies that each student with less than this minimum cumulative grade point average be either placed on academic probation or dismissed from ESF. The recommendation on probation or dismissal will be based upon an overview of the total academic record and the mathematical possibility for attaining a 2.000 cumulative average by the projected graduation date. The Dean of Instruction and Graduate Studies will take final action and so inform each student in writing.

Each student dismissed will be given the opportunity to appeal that decision based on any extraordinary conditions which may have contributed to the student's unsatisfactory performance. This appeal must be made in writing and submitted to the Office of the Dean of Instruction and Graduate Studies within the stated time limit. Each appeal will be reviewed by the Faculty Subcommittee on Academic Standards which will recommend to the Dean of Instruction and Graduate Studies either to sustain the dismissal or place the student on probation. The Dean of Instruction and Graduate Studies will take final action and so inform each student in writing. There is no appeal beyond this process.

Students who have been dismissed for academic performance may not reapply until at least one semester has elapsed. Courses taken during the dismissal period may not be applied to the student's academic program.

Students dismissed a second time for academic performance may not again be considered for readmission.

Graduation Requirements

Students are responsible for meeting the following requirements for graduation:

1. Matriculated status as an undergraduate student;
2. All course requirements must be satisfied;
3. A minimum cumulative grade point average of 2.000 (4.000=A) for all courses taken as a matriculated student at ESF;
4. At least 24 of the last 30 credits must be registered for through ESF;
5. Consistent with the State Education Department requirements, a total of at east 120 credits from courses accepted as transfer credit by ESF and courses successfully completed while a matriculated student at ESF.

Exceptions to Curriculum and Academic Policy Requirements

Exceptions to academic policies stated in this document and curriculum requirements may be made by the Faculty Subcommittee on Academic Standards which may delegate this authority. Exceptions may not violate standards established by the State University of New York or the State Education Department.

Exceptions must be requested on a petition form which must have a recommendation from the student's advisor and Faculty Chair or his designee. In those cases where an action is requested involving a specific course, the petition must also have a recommendation from the course instructor.

Graduation Rate

Of the transfer students who began their studies in the fall of 1989 at ESF, 83 percent received their degree, or continued in a five-year program, after four semesters of study. For those who began in the fall of 1990, approximately 84 percent received their degree, or are continuing in a five-year program, after four semesters of study. Fur-

ther information on student retention is available from the Office of the Dean of Instruction and Graduate Studies.

Graduate Academic Policies

Statement of Objectives

The objectives of graduate degree programs at ESF are to educate graduate students to (1) think critically and independently, (2) comprehend the processes of science and effectively apply scientific and professional procedures, (3) attain proficiency in the current level of knowledge in their respective fields, (4) become competent in the requisite technical skills and tools, (5) practice high standards of performance as scientists, educators, and professionals, and (6) exercise ethical conduct in their relationships with colleagues, other professionals, and the public.

Admission

General Requirements

Admission to graduate studies is conditional upon review and acceptance of the applicant's credentials by appropriate Faculty members and upon the recommendation of the appropriate Faculty Chair to the Dean of Instruction and Graduate Studies. Employees of the College who carry faculty status in accordance with SUNY ESF faculty bylaws and are at or above the rank of assistant professor or equivalent, may not be in a matriculated status at the College. Required for admission are at minimum a bachelor's degree from a recognized institution, and generally an academic record showing at least a "B"' average for junior and senior years of the baccalaureate program or for the master's program. Also required are Graduate Record Examination scores and for some degree programs, advanced test scores; supporting letters of recommendation; and a statement of educational and professional goals. The Graduate Record Examination may be waived by a Faculty on an individual basis.

While a student is matriculated at ESF, all coursework taken at ESF and Syracuse University to meet degree requirements must be graded on a scale of "A-F", and the grades will be computed in the grade point average. As an exception, at the discretion of the instructor, courses numbered 796 and 797 may be graded on a "Satisfactory/Unsatisfactory" basis. This must be announced on the first day of class and would apply to all students enrolled in that course section. Courses numbered 898, 899, and 999 are graded on a "Satisfactory/Unsatisfactory" basis.

International Students

The College accepts international students in graduate programs if they can satisfy regular admission requirements. In addition, those who do not have an undergraduate or graduate degree from a college or university at which English was the language of instruction, must demonstrate proficiency in the English language through achievement of a score of 550 or higher on the Test of English as a Foreign Language (TOEFL).

Degrees

Master's Degrees

Three master's degrees are offered at ESF: Master of Science, Master of Landscape Architecture, and Master of Forestry degrees. Degree requirements and program alternatives are listed below.

Master of Science (M.S.)
Master of Landscape Architecture (M.L.A.)

The Master of Science degree is an academic degree offered in the following degree programs: forest chemistry, environmental and forest biology, forest resources management, environmental and resource engineering, and environmental science. Minimum requirements for the Master of Science degree are listed under Master's Degree Program Alternatives. The Master of Landscape Architecture degree is a professional degree offered in the landscape architecture degree program. The degree can be attained through all three program alternatives described below, with additional requirements as prescribed under the degree program.

Master's Degree Program Alternatives

Master of Science
and Master of Landscape Architecture

There are three program alternatives for the Master of Science and Master of Landscape Architecture degrees, namely:

1. Thesis or Project and Defense

Under this program alternative, in addition to completion of necessary coursework, students pre-

pare either (1) a research-oriented thesis which investigates a problem that initiates, expands or clarifies scientific knowledge in the field, or (2) an application-oriented project report that applies skills or techniques from the field to address a specific problem. Whichever is chosen, students are required to define an appropriate problem for investigation; review relevant information; develop a study plan; collect, analyze and interpret data; test hypotheses and draw conclusions; and relate the results to scientific theory or body of knowledge in the field.

The minimum credit hour requirement is the successful completion of 30 credits distributed between coursework and thesis or project. The applicable distributions will be determined by individual Faculties to suit the programs, with the understanding that a minimum of 18 credits is awarded for graduate level coursework, including at least 12 credit hours of coursework taken in residence at ESF, and a minimum of 6 credits, graded "S", awarded for the thesis. The student's study plan is approved by the major professor, steering committee and Faculty Chair. The student must successfully defend the thesis or project for degree completion. The thesis or project is prepared and bound according to College standards and deposited in Moon Memorial Library.

2. Academic or Professional Experience and Master's Comprehensive Examination

Under this program alternative, in addition to completion of necessary coursework, students participate in an academic or professional experience which enriches and complements the coursework of their study plan. Whatever the format of the program, its objectives, organization, procedures, and manner of documentation must be submitted in writing and must be approved by the student's major professor, steering committee, and Faculty Chair before the experience is begun.

The successful completion of a minimum of 24 credits of graduate level coursework is required for this program alternative, including at least 18 credit hours of coursework taken in residence. Additionally, a minimum of 6 credits (course number 898, graded "S") will be awarded for successful completion of the academic or professional experience, for a total minimum of 30 credits for this program alternative. The student must prepare a report satisfactory to the steering committee, and the student must pass a comprehensive examination covering the student's fields of study and academic or professional experience. The student's report on the academic or professional experience, prepared and bound according to College standards, will be maintained by the individual Faculty.

3. Coursework and Master's Comprehensive Examination

The successful completion of a minimum of 42 credits of graduate level coursework is required for this program alternative, including at least 36 credit hours taken in residence. The student's study plan is approved by the Major Professor, steering committee and Faculty Chair. Upon completion of the coursework, the student must pass a comprehensive examination covering the student's fields of study.

Master of Forestry

The Master of Forestry degree is a professional degree offered in the forest management and operations degree program. The degree is granted upon successful completion of 37 credit hours of graduate level coursework, as prescribed in the degree program. At the end of the program, the student must successfully complete a written comprehensive examination testing the student's knowledge of the material covered and the student's ability to analyze appropriate problems. No thesis or other product is required.

Doctor of Philosophy Degree

General Requirements

The Doctor of Philosophy degree is an academic degree offered in the following degree programs: forest chemistry, environmental and forest biology, forest resources management, environmental and resource engineering, and environmental science. The Doctor of Philosophy (Ph.D.) degree requires a minimum of 60 graduate credits, of which 30 to 48 credits are for coursework and 12 to 30 credits are awarded for thesis. Individual Faculties will determine the applicable credit hour requirements within these ranges to reflect individual program requirements and emphases. The graduate credits earned for a master's degree that are applicable to a student's doctoral study plan are determined on an individual basis by the steering committee. The student must pass the doctoral candidacy examination covering selected fields of study at least one year prior to thesis defense, and successfully defend the thesis. The thesis must be prepared according to College standards and will be deposited in Moon Memorial Library.

Tool Requirements

Doctoral students must demonstrate competence in at least one research tool as a requirement for graduation. Such tools include statistics, computer science, or the ability to translate technical articles in a language other than English commonly used in science. Tool requirements and standards for each doctorate program will be determined by the corresponding program Faculty.

Student Advising and Study Plan

Major Professor: Appointment and Responsibilities

The student's major professor is appointed by the Dean of Instruction and Graduate Studies, upon the recommendation of the Faculty Chair. A major professor should be appointed upon the student's matriculation into a graduate program. For the graduate student accepted into a graduate program but lacking a major professor, a temporary advisor will be appointed by the Faculty Chair. However, every effort should be made to expedite appointment of a major professor as soon as possible.

It is the duty of the major professor to fulfill a primary role as the student's mentor. Aided by other members of the steering committee, the major professor guides the student in the development and implementation of the study plan, including course selection, research planning, choice of the professional experience, facilitation of the examination schedule, and reviews of thesis or project report drafts, including a complete review of the thesis or project report before the final copy is presented for defense.

Steering Committee: Appointment and Duties

The steering committee for all master's and doctoral students is composed of the major professor and at least two faculty members or other qualified persons. Other qualified persons include faculty at other institutions, or other recognized professionals.

The student's steering committee is appointed by the Dean of Instruction and Graduate Studies, upon the recommendation of the Faculty Chair. The steering committee should be appointed within the first semester. For all students, the steering committee must be established and must have met by the end of the third semester of graduate study.

The steering committee assists the student in the development of the study plan, including the development of the student's research, project or academic/professional experience. The steering committee guides the development of the thesis or project report, including a review of the thesis or project report before the final copy is presented for defense.

Student's Study Plan

The student's study plan includes an individualized sequence of courses and a plan for research or project or academic/professional experience. The study plan, developed by the student with the advice and approval of the major professor and other members of the steering committee, must be submitted to the Faculty Chair for approval and then forwarded to the Dean of Instruction and Graduate Studies at least by the end of the third semester. The study plan can be changed during the course of each student's studies. Changes must be approved by the major professor, Faculty Chair, and the Dean of Instruction and Graduate Studies.

Examinations

Master's Comprehensive Examination

The objectives of this examination are to determine the student's breadth and depth of knowledge in the chosen field of study, and to assess the student's ability to use that knowledge creatively and intelligently. Upon the recommendation of the appropriate Faculty Chair, the Dean of Instruction and Graduate Studies appoints the master's comprehensive examination committee consisting of the student's Major Professor, steering committee and at least one other faculty member from an appropriate area. Additionally, the Dean of Instruction and Graduate Studies appoints a committee chair who is not from the Faculty of the student's degree program. The examination has both oral and written components, with the exception that the Master of Forestry degree has a written component only.

The role of the examination committee chair is to manage the examination, ensure its integrity, and represent the interests of the faculty and students. Any member of the faculty may be an observer at the oral component of any comprehensive examination. The student examinee may invite a silent student observer to attend the oral examination.

Written Examination: The chair of the examination committee receives written questions or problems addressing the objectives of this examination. The committee chair reviews the questions

and may convene the committee to discuss the examination and ensure that questions are appropriate and fair.

The major professor administers the written examination. Usually, one-half day is allocated to questions submitted by each examiner. Upon completion by the student, the examination questions are reviewed and graded by the committee members who prepared them. Then, the entire examination is reviewed by the examining committee.

Oral Examination: Where both oral and written components are required, the oral examination follows the written examination. This examination usually lasts two hours; however, the duration may be longer, if required. The questions may address written answers or other areas appropriate to the objectives of the examination. At the conclusion of the examination period, the student examinee and observers are excused from the room and the examining committee determines whether the student has passed the examination. Unanimous agreement is required to pass the student. If less than unanimous agreement is reached, the student is considered to have failed the comprehensive examination. The student can request a second examination. A student is considered to have passed the second examination if no more than one negative vote is cast. A student who has failed the second examination is terminated from the graduate program.

Doctoral Preliminary Examination

The requirement for this examination is determined by individual Faculties. The purpose of this examination is to assess the entering student's basic knowledge in the chosen field of study. The results of this examination may be used to determine the student's suitability for the doctoral program and as a guide in selecting coursework and developing a program of study.

Doctoral Candidacy Examination

The objectives of this examination are to determine the student's breadth and depth of knowledge in the chosen field of study and to assess the student's understanding of the scientific process. The doctoral candidacy examination is taken when the majority of coursework is completed. This examination must be taken at least one year prior to the thesis defense.

Upon the recommendation of the appropriate Faculty Chair, the Dean of Instruction and Graduate Studies appoints the doctoral candidacy examination committee consisting of the student's major professor, the student's steering committee, and an additional faculty member from an appropriate area. Additionally, the Dean of Instruction and Graduate Studies appoints a committee chair who is not from the Faculty of the student's degree program. The examination must have both written and oral components.

The role of the examination committee chair is to manage the examination, ensure its integrity, and represent the interests of the faculty and student. Any member of the faculty may be an observer. The student examinee may invite a silent student observer to attend the oral examination.

Written Examination: There are two alternative forms for the written component, as follows:

Form 1: The chair of the examining committee receives written questions or problems addressing the objectives of this examination. The committee chair reviews the questions and may convene the committee to discuss the examination and ensure that questions are appropriate and fair.

The major professor administers the written examination. Usually, one-half day is allocated to questions submitted by each examiner. Upon completion by the student, the examination questions are reviewed and graded by the committee members who prepared them. Then, the entire examination is reviewed by the committee.

Form 2: The student prepares a written report on a topic or problem assigned by the examining committee. The topic or problem must meet the objectives of this examination and its content cannot be directly related to the student's thesis research. The student has approximately one month to develop a thorough understanding of the assigned topic and prepare a written report. The report is reviewed by committee members and committee chair.

Oral Examination: Following the written examination under Form 1, or completion of the report under Form 2, the committee meets with the student for an oral examination usually lasting two hours. However, the duration can be longer if required. The questions may address the report or other areas appropriate to the objectives of the examination, including subject matter in allied fields. At the conclusion of the examination period, the student examinee and observers are excused from the room and the examination committee determines whether the student has passed the examination. Unanimous agreement is required to pass the student. If less than unanimous agreement is reached, the student is considered to have failed

the first doctoral candidacy examination. The student can request a second examination. A student is considered to have passed the second examination if there is no more than one negative vote. A student who has failed the second examination is terminated from the graduate program.

Thesis or Project Defense Examination

Thesis: At the conclusion of the study and research program, each doctoral candidate or master's candidate completing a thesis under Program Alternative 1 must successfully defend the thesis. The objectives of the thesis defense examination are (1) to probe the validity and significance of the data and information presented in the thesis, (2) to assess the student as a critical thinker and data analyst, (3) to evaluate the student's scientific creativity, including the student's ability to relate research results to scientific theory within the chosen field, and (4) to present the results effectively in writing.

Project: Each master's candidate completing a project under Program Alternative 1 must successfully defend the project. The objectives of the project defense are (1) to determine how well the student has applied technical skills in problem solving, (2) to assess the student's creativity and innovation in developing the project, and (3) to evaluate the significance of the student's work in the context of professional theory and practice.

Upon the recommendation of the appropriate Faculty Chair, the Dean of Instruction and Graduate Studies appoints the thesis or project defense examination committee. It consists of members of the steering committee, and at least one additional faculty member for the master's degree examination and two additional faculty members or other qualified persons for the doctoral degree examination. Additionally, the Dean of Instruction and Graduate Studies appoints a committee chair who is not from the student's degree program.

This oral examination covers principally the material in the thesis or project, as well as literature and information relating to the thesis or project.

The role of the examination committee chair is to manage the thesis or project defense, ensure its integrity and represent the interests of the faculty and student. Any member of the faculty may be an observer. The student examinee may invite a silent student observer to attend the examination. The defense examination usually lasts two hours, although this time period may be extended as required. At the completion of the examination, the candidate and observers are excused from the room and the examination committee determines whether the candidate has successfully defended the thesis. Unanimous agreement is required to pass the student. If less than unanimous agreement is reached, the student is considered to have failed the first doctoral defense examination. A student who fails the first defense may request a second defense. At the second defense, the student has passed the defense if there is no more than one negative vote. A student who has failed the second defense is terminated from the graduate program.

Evaluation

Grades

For each course completed, one of the following grades will be awarded:

Grade	Definition	Grade Points
A	Excellent	4.000
A-		3.700
B+		3.300
B	Satisfactory	3.000
B-		2.700
C+		2.300
C		2.000
C-	Minimum Passing	1.700
F	Failure	0.000
I/F, I/U	Unresolved Incomplete	0.000

Under conditions defined elsewhere, the following grades may be assigned, none of which yield grade points:

Grade	Definition
W	Withdraw
WP	Withdraw Passing
WF	Withdraw Failing
S	Satisfactory (equal to "B" or better)
U	Unsatisfactory (equal to below "B")
SAU	Audit (Satisfactory)
UAU	Audit (Unsatisfactory)
I	Incomplete

Grade Point Average

Semester and cumulative averages are based on graduate level courses only and are computed by dividing the grade points earned by the credit hours completed in all courses graded "A-F."

Incomplete Courses

A temporary grade of "I" may be assigned by an instructor only when the student is passing and has

nearly completed the course, but because of circumstances beyond the student's control, the work is not completed. The incomplete grade must be resolved prior to the end of the semester following that in which the incomplete is received. At the request of the instructor, under extraordinary conditions, the incomplete may be extended for one additional semester. If the incomplete is not resolved by the appropriate deadline, it will be changed to a grade of "I/F" or "I/U."

Academic Performance, Credit Hour Load, Transfer Credit, and Time Limits

Academic Performance

All graduate students are required to maintain at least a 3.000 cumulative grade point average (4.000 = "A") for graduate level courses. Students who do not maintain this average, or who receive two or more grades of Unsatisfactory ("U") for work on the thesis or project, will be placed on probation or dismissed from ESF by the Dean of Instruction and Graduate Studies upon the recommendation of the College Subcommittee on Academic Standards.

Credit Hour Load

To meet academic requirements, graduate students must be registered for at least one credit each semester, excluding summers, from the first semester of matriculation until all degree requirements have been completed. Students are required to register for at least one credit in the summer if they will complete all requirements during that time. There is no full-time credit hour load to meet academic requirements.

Graduate students who hold an assistantship and/or a tuition scholarship must be in a full time status each semester while holding such an award. Usually registration for nine credits equates to full time status for a student holding an assistantship.

Graduate students not holding an assistantship are considered full-time if they are registered for at least 12 credits each semester.

Master's students who have met all academic requirements except for their thesis defense or an examination and all doctoral candidates (i.e., those who have successfully completed their doctoral candidacy examination) will be considered full time if registered for at least one credit of thesis research, professional experience, or independent study and have their major professor verify in writing they are working full time on the completion of degree requirements.

For the summer, graduate students will be considered full time if registered for at least one credit of thesis research, professional experience, or independent study and have their major professor verify in writing they are working full time on the completion of degree requirements.

Transfer Credit

Up to six credits of graduate coursework in which a minimum grade of B was earned from an accredited institution and not used to complete another degree may be accepted towards completion of a master's or doctoral degree as approved by the steering committee.

Time Limits

Graduate students must complete all requirements for the master's degree within three years of the first date of matriculation. For the doctoral degree, students must complete all degree requirements within three years of passing the doctoral candidacy examination, or they will be required to retake the candidacy examination.

Procedures for Review, Grievance, Dismissal, Appeal, and Reapplication

Procedures for review, grievance, dismissal, appeal and reapplication, as developed by the ESF faculty within SUNY guidelines, will be publicized in the Graduate Student Handbook.

Area of Study

The general area of study for each master's or doctorate student is implied by the title of the program in which the degree is awarded. Areas of study may be established within degree programs by individual Faculties that further define the student's area of specialization. The student's area of study is listed on the student's transcript if identified on the study plan.

Additionally, each Faculty may offer minors identifying ancillary areas of study that may be appropriate for the degree program. A minor is equivalent to 12 or more graduate credits earned in the minor area. Courses in a minor area must be taken outside of the student's area of study. A minor is identified on the student's transcript. A minor professor must be appointed to the student's steering committee for each minor elected, in addition to the minimum complement of steering committee

members. Each minor professor can replace an additional examiner.

Competency in Communication Skills and Graduate Seminars

Communication Skills

All students entering graduate programs at ESF are expected to be proficient in communication skills, including technical writing and library skills. Students are required to have completed at least one course in technical writing and one course in library usage, either as an undergraduate or as a graduate student. Credits for such courses taken during the graduate program are not counted towards degree requirements. Alternatively, graduate students can meet the requirement by demonstrating the equivalent in experience in writing and library skills, as determined by the steering committee.

Seminars

Participation in seminars, including the preparation and presentation of technical material, is vital to the student's graduate education. All graduate students at ESF are required to participate in graduate seminars, as follows:

Topic Seminar: Each graduate student is expected to participate in topic seminars, including presentations, as determined by the individual Faculty. This requirement can be fulfilled, with appropriate approval, by seminars offered at Syracuse University or the SUNY Health Science Center at Syracuse.

Capstone Seminar: Students completing the master's degree under Program Alternative 1 or 2, or the Ph.D. degree, are required to present a "capstone seminar" on their thesis or project research, academic, or professional experience. Masters' students under Program Alternative 3 are required to present a capstone seminar on a topic chosen in consultation with the Major Professor and steering committee. The purpose of the capstone seminar is to provide an opportunity for the graduate student to present technical information to a critical body of professionals and peers. This seminar will be presented prior to the thesis defense or comprehensive examination and should be attended by the student's steering committee. Each seminar is open to the College community and will be announced collegewide to encourage attendance by students and faculty.

Course Numbering System

Courses at ESF are numbered according to the following system:

100-499 Undergraduate courses for which no graduate credit may be given.

500-599 Graduate courses designed expressly for areas of specialization in post-baccalaureate programs or in the professional program leading to the bachelor of landscape architecture. Qualified undergraduate students may enroll by permission of the instructor.

600-699 Graduate courses designed expressly for advanced levels of specialization. Undergraduate students with a cumulative grade point average of 3.000 or better may enroll in these courses with an approved petition.

700-999 Advanced graduate level courses for which no undergraduate students may register.

Shared resources courses, designated as 400/500 or 400/600, are designed when the topic coverage of both courses is the same. Separate course syllabuses are developed expressly differentiating the requirements and evaluative criteria between the undergraduate course and the graduate course. No type of crosslisting may be offered unless approved by the ESF Faculty.

Standards for Theses, Projects, and Professional Experience Reports

Collegewide standards for theses, projects, and professional experience reports are developed and specified by the Moon Memorial Library Faculty in consultation with the various Faculties and are available in the Office of the Dean of Instruction and Graduate Studies.

Statement of "Good Academic Standing"

The term "in good academic standing" means that a student is eligible or has been allowed to register for and undertake academic coursework at the College for the semester in question. In some instances the College may define a student as being "on academic probation." The mechanism of academic probation, including any accompanying constraints upon a student's activities, is intended merely as an educational device designed to encourage greater effort on the part of students who are having difficulty in meeting certain academic standards. Place-

ment on academic probation may precede denial of the right to register for academic coursework if certain conditions are not met, but a student on academic probation is considered to be in good academic standing. Any question concerning whether or not an individual student is in good academic standing will be determined by the Dean of Instruction and Graduate Study.

Religious Beliefs Law

Students unable, because of religious beliefs, to attend classes on certain days are guided by Section 224a of the New York State Education Law which is as follows:

1. No person shall be expelled from or be refused admission as a student to an institution of higher education for the reason that he is unable, because of his religious beliefs, to attend classes or to participate in any examination, study or work requirements on a particular day or days.
2. Any student in an institution of higher education who is unable, because of his religious beliefs, to attend classes on a particular day or days shall, because of such absence on the particular day or days, be excused from any examination or any study or work requirements.
3. It shall be the responsibility of the faculty and of the administrative officials of each institution of higher education to make available to each student who is absent from school, because of his religious beliefs, an equivalent opportunity to make up any examination, study or work requirements which he may have missed because of such absence on any particular day or days. No fees of any kind shall be charged by the institution for making available to the said student such equivalent opportunity.
4. If classes, examinations, study or work requirements are held on Friday after four o'clock post meridian or on Saturday, similar or makeup classes, examinations, study or work requirements shall be made available on other days, where it is possible and practicable to do so. No special fees shall be charged to the student for these classes, examinations, study or work requirements held on other days.
5. In effectuating the provisions of this section, it shall be the duty of the faculty and of the administrative officials of each institution of higher education to exercise the fullest measure of good faith. No adverse or prejudicial effects shall result to any student because of his availing himself of the provisions of this section.
6. Any student, who is aggrieved by the alleged failure of any faculty or administrative officials to comply in good faith with the provisions of this section, shall be entitled to maintain an action or proceeding in the supreme court of the county in which such institution of higher education is located for the enforcement of his rights under this section.

Student Life

Housing

College students may seek housing with Syracuse University Residence Services, the residence halls at the State University of New York Health Science Center, or one of the many off-campus options. The College of Environmental Science and Forestry does not operate its own residence facilities or food service.

Unless they commute from home, freshmen are expected to live in Syracuse University residence halls. Sadler and Lawrinson, which are adjacent to the College campus, are designated as the "ESF cluster." Sophomores are also expected to live in university housing. A maximum of 50 upperclass students from ESF may also choose to live in SUNY Health Science Center residence halls.

Syracuse University housing is within walking distance of the ESF campus, but students may ride free shuttle-buses or city buses between campus and their residence. Students have a choice of living centers, which includes large residence halls, apartment houses, fraternity and sorority houses, or cooperative units. Freshmen and sophomores typically are assigned to Sadler or Lawrinson on the main campus, while upperclassmen may opt for South Campus apartments. Student resident advisors live on each floor or in each unit of residence halls, and are available for counseling, advisement, and referral services. Contracts for room and board made with Syracuse University cover a full academic year — both fall and spring semesters — and are not normally renegotiable during that time period.

Syracuse University also has housing for married students and their families available in the South Campus area.

For more information about costs and availability, contact Residence Services, 202 Steele Hall, Syracuse University, Syracuse, New York 13244, (315) 443-2721.

Students who prefer to find their own housing can get a free list of area apartments from Alternative Action Services (ALTERACTS), (315) 443-5188, which is a student-run organization located in the Schine Student Center at Syracuse University.

Child Care

Onondaga County offers a variety of options for child care. These include 65 licensed day care centers, 62 programs for school age children, 70 nursery and preschool programs, and about 200 legally operated family day care homes. The Onondaga County Child Care Council offers a free referral service. For more information, telephone (315) 472-6919.

In addition, two of our neighboring educational institutions have on-site child care facilities. Syracuse University Day Care Center (443-4482) can accommodate 60 children from 2 months to 6 years of age. The Health Science Center Child Care Center (464-5540) can accommodate 66 children from 8 weeks to 5 years of age once their expansion project is completed. Both centers welcome the children of ESF students on a space available basis.

Food Services

Syracuse University offers different meal plans to help meet the various needs and interests of individual students. Students living in residence halls without full kitchen facilities are required to subscribe to a meal plan, while students living in university apartments, co-ops, fraternities and sororities, or off-campus, may purchase a meal plan if they so desire.

The College does not provide food services. However, The Gallery, located in the basement of Marshall Hall, offers snacks and light meals from 7 a.m. to 2:30 p.m. weekdays during the academic year.

Health and Medical Facilities

Students may consult a physician for medical care or health advice at the Syracuse University Health Service, 111 Waverly Avenue, (315) 443-2666. Full-time students are entitled to unlimited visits to the out-patient clinic and 10 days of ordinary medical care and confinement in the infirmary per college year. Infirmary stays totaling more than 10 days will be charged at prevailing infirmary rates. There are separate charges for all X-rays, medications, and some laboratory tests.

Student accident or health insurance plans not

only supplement the usual infirmary privileges, but can provide health protection during the summer months when students are not under the care of the Health Service. Married students with dependents who are not covered by Health Service privileges are strongly urged to purchase health insurance made available to students through ALTERACTS.

All international students, as well as faculty and students planning to study abroad, are required to carry health and accident insurance supplied by the State University of New York. Further details about this policy are available from SU's International Student Office, 310 Walnut Place, (315) 443-2457, or from the ESF Office of Student Affairs and Educational Services.

Services

College Career and Counseling Services

The Office of Career and Counseling Services is available to students who seek the advice of an experienced counselor, and should be contacted whenever personal questions or problems arise. Problems requiring further assistance may be referred to the appropriate office at Syracuse University, or to specialized agencies in Syracuse.

The Career and Counseling Services staff helps students adjust to life at ESF, successfully graduate from the College, and make the transition into the work force. Through various presentations, counseling sessions, group activities and workshops, students can develop their decision-making, studying, and time-management skills. Other programs explore the adjustments students must make when entering college or transferring between institutions.

The office also provides career counseling to meet the individual needs of students at various stages of their education and/or employment search through a variety of materials and presentations. The career services offered include skills development workshops, job lists, on-campus recruiting visits, company literature, career newsletters, and reference information. A bi-weekly job list is provided to new graduates for six months at no cost, and to alumni by subscription.

The office also conducts an annual Placement Survey to monitor the success and progress of ESF graduates. The reports are available at the Office of Career and Counseling Services.

Syracuse University offices provide additional assistance for a broad range of concerns or difficulties include the Office of Student Assistance, the Counseling Center, the Goldberg Marriage and Family Therapy Center, the Hendricks Chapel staff and denominational chaplains, the Psychological Services Center, the Office of International Services, and the Campus Mediation Center. Students who want an analysis of their aptitudes, abilities, and interests may seek assistance at the university's Testing and Evaluation Service Center.

Academic Support

Academic support services for learning disabled students, as well as students requiring tutorial and remedial assistance, are available through the Syracuse University Center for Academic Achievement. Students with identified learning disabilities should contact the ESF Office of Student Affairs and Educational Services so that appropriate services can be provided.

Services for Disabled Students

Students who experience temporary disabilities or incapacitating injuries that require special transportation or classroom assistance should contact the Office of Student Affairs and Educational Services.

The office staff provides specialized support services and helps more permanently disabled students obtain maximum academic, social, and cultural benefits within the College community. The College is also prepared to respond to disabled students' needs for personal and career counseling, and job placement assistance. For further information contact the Office of Student Affairs and Educational Services, or the College's 504 Coordinator in the Office of Administration.

The Gebbie Speech and Hearing Clinics at Syracuse University provide free remedial assistance to all regularly enrolled students who may have hearing, speech, and/or voice disabilities. To reach Syracuse University Disabled Student Resources/ Office for Student Assistance, 804 University Avenue, telephone (315) 443-4357, or 443-5019 for a Telecommunication Device for the Deaf (TDD).

The College maintains liaison relationships with local and state rehabilitation agencies, including the Office of Vocational and Educational Services for Individuals with Disabilities (VESID). Students should contact the proper agency for specific information about eligibility.

Public Safety

The Public Safety Department at ESF operates 24 hours per day, seven days per week. There is also a network of emergency telephones and intercoms throughout the campus.

Anything of a dangerous or suspicious nature should be reported to the Public Safety Department office in the basement of Bray Hall, (315) 470-6666. The department also handles questions about on-campus parking and off-hour entrance to campus buildings.

Extracurricular Activities

Students at the College can choose from extracurricular activities at both ESF and Syracuse University, as well as within the City of Syracuse, Onondaga County, and the surrounding area.

At ESF

The Undergraduate Student Association (USA) and the Graduate Student Association (GSA) are the official representative bodies on campus governing student organizations. Both undergraduate and graduate students elect representatives from each Faculty to the associations, which manage the affairs and respond to the concerns of their constituents.

The two organizations sponsor a variety of events funded by student activity fees. The events include the All-College Welcome Back Picnic held the first weekend of the fall semester; the Fall Barbecue, a day of informal team competition and outdoor fun held as part of Parent/Family Weekend; the December Soirée, a formal dance; and the Spring Awards Banquet, where students, faculty, and staff are recognized for their contributions to the College community. The associations also host several graduate and all-campus "TGIFs" each semester.

The GSA produces the Graduate Student Handbook to assist new graduate colleagues in becoming acclimated to the College. The organization also sponsors an annual professional lecture series, and several social events enjoyed by students, staff, and faculty.

Several other campus organizations offer students opportunities to broaden their knowledge, gain experience and leadership skills, and meet other students with similar interests. These groups include the Bob Marshall Club, an organization of students concerned about the future of the Adirondack Mountains; the Forestry Club, sponsor of the intercollegiate Woodsmen's Team; Forest Engineers Club; Mollet Club, an organization of landscape architecture students; Papyrus Club; and the Recycling Club.

Other groups include the: honor society *Alpha Xi Sigma,* which sponsors service activities and such campuswide events as College Bowl; *Alpha Phi Omega,* a service and social fraternity; and *Kappa Phi Delta,* an ESF-affiliated social-professional fraternity located in Syracuse University's "Greek" neighborhood; *Gamma Delta Theta,* founded in 1991 as ESF's first sorority; Chinese Student and Scholar Association; and the Baobab Society, representing the interests and concerns of underrepresented student populations at the College.

There are also student chapters of The Wildlife Society, the Society of American Foresters, the American Chemical Society, the American Fisheries Society, the American Society of Landscape Architects, the Associated General Contractors, the Technical Association of Pulp and Paper Industries, the Association for Women in Science, and the American Water Resources Association.

The school's two major student publications are the Knothole, a weekly newspaper, and the Empire Forester, an annual yearbook which has won several awards.

For more information about extracurricular activities contact the Office of Activities and Organizations.

At Syracuse University

Students at the College enjoy the same privileges as Syracuse University students. They may participate in student government or join any of the scores of Syracuse University student groups, which include a wide variety of clubs, the International Student Association, religious and military organizations, and professional and honor societies.

College students may also perform with the Sour Sitrus Society "pep" band, Hendricks Chapel Chorus, Black Celestial Chorale Ensemble, and other performance/arts organizations.

The Archbold and Flanagan gymnasiums are the center of athletics and physical education at Syracuse University, and are adjacent to the ESF campus. Additional indoor facilities are available at Manley Field House and the Carrier Dome, which is the site of Syracuse University's home football, basketball, and lacrosse games. The Women's Building offers instructional, social, and recreational facilities around the corner from the College quad. Facilities on South Campus include a lodge, 22 tennis courts, and a Nautilus exercise room in the new Goldstein Student Center.

Although students at the College can take part in

Syracuse University club and intramural sports, the university does not allow ESF students to participate on its Division I intercollegiate teams due to National Collegiate Athletic Association guidelines.

ROTC Opportunities

Many students attending the College are eligible to participate in the Army or Air Force ROTC Program at Syracuse University.

The Reserve Officer Training Corps programs consist of both two- and four-year programs. Students attending the College for two years can gain admission to either the Army or Air Force program through participation in summer training. Both four- and six-week camps and on-campus programs are available to suit the individual needs of students. The ROTC programs offer academic instruction, alternate and supplementary career opportunities, leadership experience, and financial aid.

For more information contact Air Force ROTC, 303 Archbold Gymnasium, (315) 443-2461, and/or Army ROTC, 308 Archbold Gymnasium, (315) 443-2462.

Alumni Association

The Alumni Office serves as the liaison between the College, the Alumni Association Board of Directors, and ESF's more than 13,000 alumni. The association supports educational programs through scholarships, publishes a quarterly newsletter, and represents concerns of ESF graduates.

Student Rules and Regulations

The complete guidelines for academic and social conduct for all students attending the College is found in the ESF Code of Student Conduct, which is distributed annually. The guidelines pertain to all students, and it is each student's responsibility to be familiar with the regulations and to abide by them.

All students receive copies of informational materials related to prevention of sexual harassment, campus security and crime statistics, and drug-free campus programs.

Syracuse

The College of Environmental Science and Forestry is adjacent to Syracuse University on one of several hills that overlook downtown Syracuse and nearby Onondaga Lake. The metropolitan area, home to more than 650,000 people, and the surrounding countryside offer a variety of cultural, educational, and recreational opportunities.

The city has several fine museums, including the Everson Museum of Art with its outstanding collection of works by local, national, and international artists. Syracuse Stage is known for its professional theater productions, while the Syracuse Symphony Orchestra is one of the nation's finest, and the downtown Civic Center features performing artists from around the world. The area features several colleges and universities. The State University of New York Health Science Center at Syracuse, Le Moyne College, and Onondaga County Community College join ESF and Syracuse University in the city, while Cazenovia College is nestled in a nearby suburb. There are many other institutions of higher education within a short drive, including Colgate College, Cornell University, Hamilton College, Ithaca College, SUNY-Cortland, SUNY-Oswego, and Utica College.

There are eight parks in the city, and numerous county and state parks, including Beaver Lake Nature Center and Montezuma National Wildlife Refuge, are within a short distance. The Adirondacks, Lake Ontario, the Finger Lakes, downhill and cross-country skiing facilities, and golf courses are also within easy driving distance, and make Central New York a haven for recreation and nature lovers.

Once home of the salt industry, the "Salt City" is now a metropolitan area of diversified industry and commerce. The area is a leader in the manufacture of air conditioning equipment, automotive parts, china, pharmaceuticals, lighting equipment, and medical diagnostic equipment.

Syracuse is called the Crossroads of New York State, because it is situated at the intersection of two major highways: the 500-mile east-west New York State Thruway (Interstate 90) and the north-south Penn-Can Highway (Interstate 81). The highways cut the driving time to New York City, Boston, Philadelphia, Toronto, or Montreal, to approximately five hours, while Buffalo and Albany are less than three hours away.

The city is also served by the modern Hancock International Airport, Amtrak, and major bus lines, which makes it a convenient home for students and faculty alike.

The Campuses

The College operates a multiple campus system with regional campuses and field stations located in Syracuse, Tully, Wanakena, Warrensburg, Cranberry Lake, Newcomb, and Clayton. This system is composed of about 1 million square feet of facilities in 186 buildings on 25,000 acres of land.

The Syracuse Campus

The main campus in Syracuse lies on 12 acres adjacent to Syracuse University in an area that traditionally has been known as "The Hill." The principal instructional programs at the bachelor's, master's, and doctoral degree levels are on the Syracuse campus. In addition, the main campus houses important research organizations such as the Empire State Paper Research Institute, the Polymer Research Institute, a cooperative research unit of the U.S. Forest Service, and the Ultrastructure Center.

A vast array of programs are housed in the five main academic buildings: Baker Laboratory, and Walters, Bray, Marshall, and Illick halls. The main campus is also home to Moon Library.

Moon Library

The F. Franklin Moon Library and Learning Resources Center contains more than 106,000 cataloged items, 1,846 serials and abstracts, and receives 1,084 journals. The collection constitutes a specialized information source for the forestry, environmental science, and landscape architecture programs of the College. The collection has concentrations in such areas as botany and plant pathology, biochemistry, chemical ecology, forest chemistry, polymer chemistry, economics, entomology, environmental studies, landscape architecture, environmental design, management, paper science and engineering, photogrammetry, silviculture, soil science, water resources, world forestry, wildlife biology, wood products engineering, and zoology.

The Syracuse University libraries, including the Science and Technology Library immediately adjacent to the ESF campus, and the libraries at the SUNY Health Science Center at Syracuse are within walking distance of ESF. Students at the College are encouraged to refer to those collections if what they need is not in Moon Library.

Other collections located throughout New York State and the United States are readily accessible through inter-library loan. All Syracuse University collections may be searched by using an on-line public access catalog located in Moon Library.

The library building opened in 1968, and can seat 400 people. The main reading areas are located on the upper level adjacent to the open stacks, and are divided by the library catalog and reference service area. The library contains a current periodical room, a bibliographic center containing indexes and abstracts, individual study carrels, and library faculty offices. The Hoverter Archives and special collections, conference room, and computer terminal room are located on the lower level.

The archives contains historical items relevant to the College and forestry development in New York State. The special collections area of the archives includes rare, scarce, and valuable books and folios, as well as the Fletcher Steele collection on landscape architecture and the Thomas Cook collection on papermaking.

Public services provided by the library faculty and staff include a credit course in library research, orientation, class lectures, study guides, user aids, and reference desk services.

Moon Library is a member of the SUNY OCLC network for cataloging and interlibrary loans.

Academic Computing Services

The College provides academic computing services in several ways and at several locations. Public clusters of microcomputers are maintained as combinations of open-shop/classroom facilities for general collegewide use. One of the clusters contains 20 Macintosh SE/30s, another houses 15 Macintosh SEs, and a third has 15 IBM PS/2-55SXs networked together for high-level local use of both simple and sophisticated software, and for communication to external hosts as needed.

Another public cluster contains a total of 16 VDT and four KSR terminals connected at 9600 bps to a network of mainframe computers at Syracuse University. Other clusters contain microcomputers for specialized uses such as graphics and geographic information systems. Semipublic clusters of microcomputers and terminals are also provided in each of the academic buildings on the main campus, and at some of the field campuses.

The host systems on the Syracuse University Academic Computing Service (SUACS) network are

accessible at ESF, and consist of an IBM 3090/150 and a mixture of DEC VAX configurations. Using SUACS as a hub, ESF has access to external networks such as NYSERNET, BITNET, and FASTNET.

Analytical and Technical Services

Analytical and Technical Services (ATS) provides an array of centralized analytical services such as gas chromatography-mass spectrometry, nuclear magnetic resonance spectrometry, and inductively coupled plasma emission spectrometry. ATS also provides other services including operating a chemical and laboratory apparatus stockroom, microcomputer repair, instrument and equipment repair, micromechanical repair and experimental apparatus fabrication, and scientific glassblowing.

Specialized Facilities

Specialized facilities on the Syracuse campus include electron microscopes, plant growth chambers, air-conditioned greenhouses, a bio-acoustical laboratory, a 1,000-curie cobalt-60 radiation source, radioisotope laboratory, computing center, and specialized instrumentation, including a new 300 MHz nuclear magnetic resonance spectrometer with both liquids and solids capability, electron spin resonance spectrometer, gas chromatography, mass spectrometer, ultracentrifuge, and X-ray and infrared spectrophotometer.

The paper science and engineering laboratory features a semicommercial paper mill with accessory equipment. The wood products engineering department has a complete strength-of-materials laboratory as well as a pilot-scale plywood laboratory and a machining laboratory.

Greenhouses and forest insectary are used to produce plant and insect material for classroom and laboratory instruction. Extensive collections are available for study, including wood samples from all over the world, botanical materials, insects, birds, mammals, and fishes.

Instructional Services

The Instructional Services unit of the Learning Resources Center directly supports the program areas of the College through instructional development and application of media materials for the classroom, for the presentation of research findings, and for public service endeavors.

The instructional development services include television programming, as well as slide, tape, and photographic services. Other services include engineering, audio-visual equipment distribution, and maintenance and support functions. The instructional services staff also participates directly in instructional programs at both the undergraduate and graduate levels.

Geographic Information Systems

The environment is inherently spatial, or geographic, and better consideration of spatial relationships and characteristics may revolutionize understanding and management of environmental processes and conditions. Modern technology, especially in computing and information management, is providing the tools necessary for this improved understanding Specifically, geographic information systems provide the powerful tools needed for a coordinated, cross-disciplinary effort in geo-spatial modeling and analysis (GMA).

Geographic information systems are collections of capabilities for acquiring, storing, managing, manipulating, analyzing, displaying, and reporting data or information which has locational or spatial attributes. The College faculty recognizes the power and utility of GIS for generating fundamental knowledge about the world, and for many practical environmental applications. These environmental topics cover the breadth of programs at ESF, including natural resources management, environmental and biological science, local and regional planning, engineering, and design of facilities and sites.

In recognition of the importance of GMA to all programs of study and research at the College, the campuswide Council for Geo-spatial Modeling and Analysis (CGMA) was formed in 1991. This unique group consists of faculty and professional staff from the many academic units which are active in the various aspects and applications of GMA. The council emphasizes communications and cooperation in order to develop coherent programs of instruction, research, and public service for many aspects of the ESF community.

The coordination that CGMA can provide will assure continued, efficient, and effective development of the College's expertise and resources in GMA. The council formalizes a unique combination of expertise, interests, and disciplinary strengths, and will help ESF remain a recognized leader in environmental applications of GMA.

Geo-spatial modeling and analysis instruction and research at ESF builds upon existing strengths in mapping science and engineering, including surveying, photogrammetry, remote sensing, hydrol-

ogy, environmental engineering, and waste management. It also builds on strengths in environmental applications, including environmental science, natural resources management, planning, and design.

Extensive research and advanced instruction facilities are located in the College's Mapping Science Laboratory and the Environmental Design, Planning, and Visual Simulation Laboratory. These facilities continue to expand through support by SUNY, applications research, standard and continuing education programs, and special funding.

Additional resources exist at other facilities at ESF and Syracuse University, including the Advanced Graphics Research Laboratory and an internationally recognized faculty in the areas of cartographic theory and geographic analysis. The expertise and extensive facilities at ESF for spatial analysis continue to be renowned within disciplines related to environmental science, management, and design.

Any program at ESF can include a component of GIS instruction and practice with proper coordination. In addition, much more concentrated study, application, and research using GIS is available through engineering, environmental studies, forestry, and landscape architecture.

Division of Engineering faculty and students are interested in spatial data acquisition, environmental database development, environmental modeling, site selection, and facility design. The study of GIS in engineering may be coordinated with programs in photogrammetry and mapping, environmental assessment and engineering, image processing, and water resources.

Environmental studies faculty and students are interested in policy issues associated with environmental information, and applications within metropolitan environments. The Faculty's graduate and undergraduate programs offer students special opportunities to pursue an interdisciplinary program that is tailored to their needs, and can include instruction in GIS and GMA applications and research.

Forestry faculty and students use GIS to focus on forest management and planning, and range from inventory analysis through harvest planning to general multiple use forest management. Since resources management is essentially spatial in nature, both the undergraduate program in resources management and the two graduate programs, forest resources management and forest management and operations, benefit from GIS and GMA technology.

Landscape architecture students and faculty are interested in the application of CAD, GIS, and video technologies for landscape analysis, planning, and design. These technologies are integrated into both undergraduate and graduate required coursework, and advanced bachelor's of landscape architecture and master's of landscape architecture students may pursue additional specialized learning in computer applications.

The Tully Campus

The Tully Campus, which is composed of the Heiberg Memorial Forest and the Genetic Field Station is about 25 miles south of Syracuse.

Heiberg Memorial Forest is located on the northern escarpment of the Allegheny Plateau. It includes 3,800 acres of diverse terrain and forest growth. The forest is utilized both as an extensive outdoor teaching laboratory and as a site for intensive research. The Forest Ecosystem Lab, which is a highly instrumented outdoor teaching laboratory, offers a large complex of all-weather classrooms, experimental plantings from throughout the world, and a commercial-scale maple syrup operation. Each fall Heiberg Memorial Forest is the site of an intensive program for environmental and resource management students in a total ecosystem approach to forest community management instruction.

The Wanakena Campus

The Wanakena Campus, located on the Oswegatchie River about 65 miles northeast of Watertown and 35 miles west of Tupper Lake, is the site of the James F. Dubuar Forest and the Faculty of Forestry's Forest Technology Program.

The campus and its 2,800-acre instructional and demonstration forest supports the College's Associate of Applied Science degree program for the training of forest technicians. It is the oldest forest technician program in the country.

The campus is situated on the western plateau of the "Lakes Region" of the Adirondacks, and hosts the Summer Session in Field Forestry, a seven-week session devoted to introductory instruction in field forestry principles and techniques. The session is required for all students entering environmental and resource management and the dual option in environmenal and forest biology and resource management.

The Warrensburg Campus

The Warrensburg Campus is located in the southeastern Adirondack region and encompasses the Charles Lathrop Pack Demonstration Forest, an

area of some 2,800 acres of heavily forested land noted for its white pine.

The forest has been under intensive management since 1927 for the combined purpose of instruction, research, and demonstration in forestry and allied fields.

Formal offerings in continuing education and various meetings and conferences are held at the forest for practicing professionals and organizations directly associated with forestry and related environmental fields.

The Cranberry Lake Campus

The Cranberry Lake Campus, approximately 1,000 acres of forested property in the northwestern area of the Adirondacks, is the site of ESF's Biological Station.

The College operates an eight-week summer field program in environmental biology at the campus, which is bounded by 150,000 acres of New York State forest preserve lands, by Cranberry Lake, and by isolated forest bogs and beaver meadows.

The extensive facilities are intensely utilized during the summer in a comprehensive curriculum of upper-division and graduate level courses.

Use of the campus before and after the summer session program varies to include individual research projects, cooperative studies with other agencies, and visits by large groups from both the College and outside institutions.

The Newcomb Campus

Located in the central Adirondack Mountains, Newcomb is the largest of the regional campuses and home to the Adirondack Ecological Center (AEC) where extensive studies of animal biology and ecology are conducted.

The AEC is located on the Huntington Wildlife Forest, a 15,000-acre property owned by the College. It provides an exceptional resource for experimentation in ecology and natural resources management. The forest contains Rich Lake and the new $1 million Adirondack Interpretive Center, which is operated by the Adirondack Park Agency and open to the public throughout the year.

This campus is mountainous and contains a wide variety of vegetative types and wildlife. It is used year round for a general research and forest management program participated in by faculty, undergraduate and graduate students, and visiting scientists.

The Field Stations

In addition to its regional campus system, the College operates several field stations, which directly support the instruction, research, and public service programs of the institution.

The 44-acre Forest Experiment Station in Tully is a short drive from the campus in Syracuse, and is used to support main campus academic programs. The station includes a large arboretum, tree nursery, and experimental greenhouse facility.

Adjacent to the Tully campus is the College's Genetic Field Station, which is a 59-acre area devoted to relatively short-term outplantings of plant materials developed during various genetic research projects at the College. The site features an irrigation system and layout of level blocks, which makes it an excellent facility for developing hybrids, grafting, doing experiments, and for research in heritability.

The College owns a magnificent island, featuring the Ellis International Laboratory, in the heart of the Thousand Islands/St. Lawrence River area off the village of Clayton.

Accessible only by boat, the laboratory is in an appropriate spot for the collegewide, cooperative, and international environmental monitoring and research activities conducted in the St. Lawrence Seaway area.

The College's most recent acquisition is a 15-acre facility on Wellesley Island. The island property, formerly a Coast Guard Station, has shore frontage on the American channel of the St. Lawrence Seaway, and is well suited for many types of aquatic studies.

Special Opportunities

Coordinated Programs with Syracuse University

Science Teacher Certification

The College and the School of Education at Syracuse University offer selected undergraduate students an opportunity to prepare for New York State provisional teacher certification in biology, or chemistry, and general science. This opportunity is available through the following ESF programs: chemistry (leading to certification in chemistry and general science in grades 7-12); and environmental and forest biology, and environmental studies (biological science applications option) (leading to certification in biology and general science in grades 7-12).

Students who earned at least a 2.600 grade point average during their first semester at ESF and transfer students who maintained a 3.000 or greater cumulative grade point average at their previous college are eligible for the program. The following academic requirements must be met:

1. All requirements for the program as listed in this Catalog including at least 24 credits of science in the primary certification area.
2. One year of college level foreign language study, or its equivalent established through appropriate high school study and/or testing.
3. An appropriate computer use course.
4. The following Syracuse University professional education core courses:

EDU 207	Study of Teaching	3
EDU 300	Participation in the Academy of Science Educators	1 - 3
EDU 307	Principles of Teaching and Learning in Inclusive Classrooms	3
EDU 310	The American School	3

5. A formal experience (either through available courses such as EDU 315, or as a noncredit experience) in tutoring or mentoring children, adolescents, or adults.
6. To be accepted into the first professional semester, students must have their portfolio accepted by the Academy and maintain a minimum cumulative grade point average of 2.600 and a minimum 2.600 in both science and required education courses.

First Professional Semester (Spring semester only)

EDU 400	Adapting Instruction for Diverse Students Needs	3
SCE 535	Curriculum and Methods in Teaching Science	3
EDU 508	Student Teaching/Secondary	3

Second Professional Semester (Fall semester only)

Prerequisite is successful completion of the first professional semester.

EDU 507	Teacher Development	3
EDU 508	Student Teaching	9

A more detailed description of requirements and philosophy of this program and other requirements for New State Teacher Certification may be obtained from the Office of Instruction and Graduate at ESF.

Concurrent Graduate Degrees

The College and Syracuse University provide opportunities for graduate students to complete degrees concurrently at ESF and at Syracuse University in either the M.P.A. degree program in the Maxwell School of Citizenship and Public Affairs, the M.A. or M.S. degree programs in the S.I. Newhouse School of Public Communications, the M.S. degree program in the School of Education, or the M.B.A. degree program in the School of Management.

Students must complete at least one semester of graduate level coursework and earn a 3.500 grade point average or better at ESF before being considered for a concurrent degree program at Syracuse University. Students at the Syracuse University College of Law may apply for admission to a concur-

rent degree program at ESF after completing their first year of law school.

Preprofessional Advising

The College, through Syracuse University, offers preprofessional advising for students interested in careers in medicine, dentistry, veterinary science, and law.

Although some colleges of medicine and dentistry no longer require extensive background coursework in biology, most require a full-year course in general biology, general chemistry, organic chemistry, and physics. Calculus is also required in many cases. In addition to the general science background, colleges of veterinary medicine require coursework in bacteriology or microbiology, and at least one summer of practical experience in the management of poultry, pigs, cattle or horses.

Regardless of the specific prerequisites of a school of medicine, dentistry or veterinary medicine, coursework available at ESF has proven to be valuable to applicants to those professional programs.

All students applying to medical school are encouraged to form a pre-med advisory committee, which can provide letters of recommendation to the schools. The director of Syracuse University's Health Professions Advising Program can be reached at 329 Hall of Languages, (315) 443-2207.

For more information, see ESF's Career Guide Handbook for Biologists, or contact the Office of Career and Counseling Services.

Exchange Programs at Cornell University

The College and the New York State College of Agriculture and Life Sciences at Cornell University provide exchange opportunities so that graduate students can take advantage of special courses, faculty, and research facilities found at the two institutions. Cornell University is in Ithaca, N.Y., which is about 50 miles southwest of Syracuse.

Academic Programs

Degree Programs and Areas of Study

The College is authorized to award degrees in the following programs. Enrollment in other than registered or otherwise approved programs may jeopardize a student's eligibility for certain financial aid programs.

Division of Engineering, page 57.

Environmental and Resource Engineering: M.S., Ph.D., with option in *forest engineering* and areas of study in environmental management, forest engineering, geo-spatial information systems, photogrammetry and remote sensing, or water resources engineering; option in *paper science and engineering* and areas of study in chemistry of pulping and bleaching, colloid chemistry and fiber flocculation, fiber and paper mechanics, process and environmental systems engineering, or pulp and paper technology; and option in *wood products engineering* with areas of study in wood science and technology, wood anatomy and ultrastructure, tropical timbers, wood treatments, or engineered wood products and structures: timber structure design. (HEGIS Code 0999)

Division of Forest Resources, page 63.

Dual Option in Environmental and Forest Biology/Resources Management: B.S. (HEGIS Codes 0499 and 0115)

Faculty of Chemistry, page 66.

Chemistry: B.S., with options in biochemistry and natural products, environmental chemistry, or natural and synthetic polymer chemistry. (HEGIS Code 1905)

Forest Chemistry: M.S., Ph.D., with areas of study in biochemistry, environmental chemistry, organic chemistry of natural products, or polymer chemistry. (HEGIS Code 1905)

Faculty of Environmental and Forest Biology, page 72.

Environmental and Forest Biology: B.S., with elective concentrations in ecology, entomology, environmental microbiology, fish and wildlife biology and management, pest management, forest pathology and mycology, plant physiology, plant science, pre-medical science, education, or zoology. An accelerated B.S./M.S. track in plant biotechnology is also available. (HEGIS Code 0499)

Environmental and Forest Biology: M.S., Ph.D., with areas of study in ecology, entomology, environmental physiology, fish and wildlife biology and management, forest pathology and mycology, plant science and biotechnology, soil ecology, or chemical ecology. (HEGIS Code 0499)

Faculty of Environmental Studies, page 80.

Environmental Studies: B.S., with options in information and technology, land use planning, biological science applications, policy and management. (HEGIS Code 0420)

Graduate Program in Environmental Science: M.S., Ph.D., with areas of study in environmental land planning, environmental policy and democratic processes, environmental modeling and risk analysis, or water resource management. (HEGIS Code 0420)

Faculty of Forest Engineering, page 86.

Forest Engineering: B.S. (HEGIS Code 0999)

Faculty of Forestry, page 89.

Forest Technology Program: A.A.S. (HEGIS Code 5403)

Resources Management—General Forestry: B.S. (HEGIS Code 0115)

Forest Management and Operations: M.F., with areas of study in the public sector, or the private sector. (HEGIS Code 0115)

Forest Resources Management: M.S., Ph.D., with areas of study in policy and administration, forestry economics, forest management, recreation management, watershed management/hydrology, silviculture, silvics, forest soil science, tree improvement, international forestry, urban forestry, quantitative methods, or resources information management. (HEGIS Code 0115)

Faculty of Landscape Architecture, page 105.

Landscape Architecture: B.L.A. (HEGIS Code 0204)

Landscape Architecture: M.L.A. (HEGIS Code 0204)

Faculty of Paper Science and Engineering, page 112.

Paper Science and Engineering: B.S., with options in science, or engineering. (HEGIS Code 0999)

Faculty of Wood Products Engineering, page 118.

Wood Products Engineering: B.S., with options in construction, or wood products. (HEGIS Code 0999)

Freshman Residency

The College of Environmental Science and Forestry accepts a limited number of students into a Freshman Residency Program that prepares them to enter many of the upper division programs of the College. Students interested in this program should refer to page 15 for information on freshman admissions.

Students who meet the admissions criteria and are interested in pursuing a degree in environmental and forest biology, resources management, the dual option of environmental and forest biology and resources management, or chemistry should review the Sciences and Management Track on page 56. Students interested in paper science and engineering, or forest engineering should review the Sciences and Engineering Track on page 55.

Students accepted into either of these tracks complete the required program through a combination of courses taken at ESF, Syracuse University, or advanced standing granted through AP, CLEP or other appropriate programs.

Freshmen who enter through one of these tracks should note that because of opportunities to take some specialized courses at ESF not normally available at pre-ESF institutions, there may be some alteration of their upper division program compared to those who transfer to ESF directly into the junior year program.

Sciences and Engineering Track

Students entering the Sciences and Engineering Track with the intention of pursuing the upper division program in paper science and engineering should observe the following guidelines when planning their program.

Electives taken throughout the full four-year curricula must include at least nine credit hours in social sciences or humanities, at least three of which should be upper division. Humanities coursework deals with branches of knowledge concerned with man and his culture, while social sciences coursework con-

cerns individual relationships in and to society. Traditional subjects in these areas are philosophy, religion, history, literature, fine arts, sociology, psychology, anthropology, economics, and modern languages beyond the introductory skills courses, while modern nontraditional subjects are exemplified by courses such as technology and human affairs, history of technology, and professional ethics and social responsibility.

Subjects such as accounting, industrial management, finance, personnel administration, ROTC studies, and skills courses, such as public speaking and technical report writing, do not fulfill the humanities and social science requirement.

Students who have advanced placement credits are encouraged to work closely with their advisor in order to best prepare for various upper division elective sequences in technology, science, design or management.

Sciences and Management Track

Students entering the Sciences and Management Track with the intention of pursuing the upper division program in environmental and forest biology, resources management, or the dual option of environmental and forest biology and resources management, should consider the following guidelines when planning their program:

Environmental and forest biology: electives taken throughout the full four-year curriculum must include at least nine credits of social sciences/humanities. Electives must also include one course from each of Groups A and B listed below.

Group A
Elements or Principles of Entomology
Invertebrate Zoology
Environmental Microbiology

Group B
Dendrology
Plant Diversity
Forest Pathology

Students must also take a minimum of six credits each of animal and plant sciences, which may include courses from Groups A and B not used as noted above. Finally, a minimum of nine credits in biology at the upper division (numbered 300 or higher) are required.

Students must also take the soils course or one of the following: geology, climatology, earth science, or meteorology.

Resources management: electives taken throughout the full four-year curriculum must include at least nine credits of social sciences (anthropology, economics, geography, history, political science, sociology, and psychology); nine credits of humanities (art, music, foreign languages, philosophy, and literature); nine credits dealing with at least two major resources (forage, minerals, recreation/ amenities, water, wildlife, and wood); and another three credits in the area of forest protection (entomology, pathology, and fire). Of the total of 42 credits of electives in the four-year curriculum, at least six credits must be taken in two or more of the faculties at ESF other than Forestry.

Students may take PSC 122, American State and Local Government and Politics, in place of or concurrent with PSC 121, American National Government and Politics.

Dual option in environmental and forest biology and resources management: electives taken throughout the full nine semester curriculum must include at least nine credits of social sciences/humanities, one course from each of Groups A and B as listed above, a minimum of six credits each of animal and plant sciences, a protection course (entomology, or pathology if not chosen from Groups A and B; otherwise this becomes a biology upper division elective), and a minimum of nine credits of upper division biology (number 300 or higher).

Students may take PSC 122, American State and Local Government and Politics, in place of or concurrent with PSC 121, American National Government and Politics.

Sciences and Engineering Track

Freshman Year

Fall				Spring			
EFB	226	General Botany	4	PHY	211	Physics I	3
CHE	106	General Chemistry	3	PHY	221	Physics Lab I	1
CHE	107	General Chemistry Lab	1	CHE	116	General Chemistry	3
MAT	295	Analytical Geometry & Calculus	3	CHE	117	General Chemistry Lab I	1
WRT	105	Writing Studio	3	MAT	296	Calculus II	3
ESF	132	Seminar for New Students	1	EFB	220	Global Environment	3
		Elective--Hum/Soc Sci	3	APM	153	Computing Methods	3
			18/14*				17

Sophomore Year

Paper Science and Engineering

Fall				Spring			
PHY	212	Physics II	3	FCH	223	Organic Chemistry II	3
PHY	222	Physics Lab II	1	FCH	224	Organic Chemistry Lab II	2
FCH	221	Organic Chemistry I	3	ETS	141	Reading & Interpretation	3
FCH	222	Organic Chemistry Lab I	2	FOR	206	Microeconomics	3
MAT	397	Calculus III	3	MAT	585	Differential Equations	3
CHE	332	Quantitative Analysis	2			Elective--Hum/Soc Sci	3
CHE	333	Quantitative Analysis Lab	1				17
PSE	300	Introduction to Pulp & Paper	3				
			18				

Forest Engineering

Fall				Spring			
PHY	212	Physics II	3	ERE	362	Mechanics of Materials	3
PHY	222	Physics Lab II	1	ERE	222	Engineering Mech - Dynamics	2
ERE	221	Engineering Mech - Statics	3	MAT	398	Calculus IV	3
ERE	225	Engineering Graphics	1	ELE	221	Electrical Science I	3
MAT	397	Calculus III	3	ETS	141	Reading & Interpretation	3
FOR	206	Microeconomics	3	FOR	205	Macroeconomics	3
		Elective--Hum/Soc Sci	3				17
			17				

*With the advisor's approval, the actual course load may be less and is dependent on advanced placement credits and future program selection.

Sciences and Management Track

Freshman Year

Fall

EFB	226	General Botany	4
CHE	106	General Chemistry	3
CHE	107	General Chemistry Lab	1
MAT	295	Analytical Geometry & Calculus	3
WRT	105	Writing Studio	3
ESF	132	Seminar for New Students	1
		Elective--Hum/Soc Sci	3
			18/14*

Spring

EFB	285	Principles of Zoology	4
CHE	116	General Chemistry	3
CHE	117	General Chemistry Lab	1
EFB	220	Global Environment	3
ETS	141	Reading & Interpretation	3
APM	155	Computing Methods	3
			17

Sophomore Year

Resources Management

Fall

PHY	211	Physics I	3
PHY	221	Physics Lab I	1
EFB	320	General Ecology	3
FOR	200	Intro to Resource Management	3
FOR	206	Microeconomics	3
		Elective--Hum/Soc Sci	5
			17

Spring

FOR	345	Soils		3
PSC	121	Amer Nat Govt & Politics		3
SOC	121	Social Perspectives	3	3
		or		
PSY	205	Foundations of Human Behavior	3	
		Elective--Hum/Soc Sci		8
				17

Environmental and Forest Biology

Fall

PHY	211	Physics I	3
PHY	221	Physics Lab I	1
EFB	320	General Ecology	3
FCH	221	Organic Chemistry I	3
FCH	222	Organic Chemistry Lab I	2
		Elective--Hum/Soc Sci	3
			15

Spring

FOR	345	Soils		3
PHY	212	Physics II	3	
PHY	222	Physics Lab II	1	
		and/or		
FCH	223	Organic Chemistry II	3	3-12
FCH	224	Organic Chemistry Lab II	2	
		and/or		
MAT	296	Calculus II	3	
		Elective--Biology		3-9
				15-18

Dual Major -- Environmental and Forest Biology and Resources Management

Fall

PHY	211	Physics I	3
PHY	221	Physics Lab I	1
EFB	320	General Ecology	3
FCH	221	Organic Chemistry I	3
FCH	222	Organic Chemistry Lab I	2
FOR	206	Microeconomics	3
		Elective--Hum/Soc Sci	3
			18

Spring

FOR	345	Soils		3
PHY	212	Physics II	3	
PHY	222	Physics Lab II	1	
		and/or		
FCH	223	Organic Chemistry II	3	3-5
FCH	224	Organic Chemistry Lab II	2	
		and/or		
MAT	296	Calculus II	3	
PSC	121	Amer Nat Govt & Politics		3
		Elective--Hum/Soc Sci		6
				15-16

Chemistry

Fall

PHY	211	Physics I	3
PHY	221	Physics Lab I	1
FCH	221	Organic Chemistry I	3
FCH	222	Organic Chemistry Lab I	2
FOR	206	Microeconomics	3
SPC	325	Presentational Speaking	3
		Elective--Hum/Soc Sci	3
			18

Spring

FCH	223	Organic Chemistry II	3
FCH	224	Organic Chemistry Lab II	2
PHY	212	Physics II	3
PHY	222	Physics Lab II	1
MAT	296	Calculus II	3
		Elective--Hum/Soc Sci	3-6
			15-18

*With the advisor's approval, the actual course load may be less and is dependent on advanced placement credits and future program selection.

Division of Engineering

ROBERT H. BROCK, Director
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Graduate Program in Environmental and Resource Engineering

ROBERT V. JELINEK
Graduate Studies Coordinator
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The graduate program in Environmental and Resource Engineering (ERE) is concerned with the application of science and engineering to the conservation, restoration, holistic development, and improved utilization of the natural environment and its forest-related resources. It represents synthesis of the professional specialties of three academic faculties which comprise the Division of Engineering. These are the Faculty of Forest Engineering (FEG), the Faculty of Paper Science and Engineering (PSE), and the Faculty of Wood Products Engineering (WPE).

The master of science and doctor of philosophy degrees are awarded in ERE.

The College graduate admissions and academic policies are given on pages 19 and 33. Graduate students in the Division of Engineering generally follow these policies. The minor exceptions are given below.

The Graduate Record Examination is encouraged and expected, but may be waived in exceptional circumstances, on an individual basis. Applicants are required to have a bachelor's degree in science or engineering. At least one year of study in each of the following subjects is expected: biological science, calculus, chemistry, computer science and physics.

With reference to the master of science degree in environmental and resource engineering, only program alternative 1 (Thesis or Project and Defense) and a minimum of 30 credit hours are accepted. Details for program alternative 1 and the distribution of the required 30 credit hours are given on page 33.

Under general requirements for the Ph.D. degree (page 34), the environmental and resource engineering program requires a minimum total of 60 graduate credits, to include a minimum of 30 credits of coursework, and allow a maximum of 30 credits for thesis. As tool requirements, students must demonstrate competence in two of the three following areas: computer science, statistics or advanced mathematics, and a language other than English commonly used in science or engineering practice. The doctoral preliminary examination is required of all students who have not earned a master's degree corresponding to the above alternative 1.

A study plan which formally identifies an individual student's program requirements is developed for each student as soon as possible, but at least during the first year of graduate study. This plan includes all required and elective courses as well as a tentative schedule for completion.

Options, areas of study, and study plans are all developed and implemented using, as necessary, the full resources of the Division of Engineering, the College of Environmental Science and Forestry, Syracuse University, and other SUNY institutions.

Options and Areas of Study

Options are alternative curricular requirements addressing different subjects within a degree program. Areas of study identify subject areas within options in which there is significant and continuing institutional strength.

Within the graduate program in environmental and resource engineering there are three options: forest engineering, paper science and engineering, and wood products engineering. Each option has several areas of study as noted below.

Forest Engineering Option

Environmental Management

Participating Faculty: DUGGIN, HASSETT, HOPKINS, JELINEK, LEE, MCCLIMANS, PALMER, SMITH, TOLL, and select nonengineering faculty.

- Environmental Modeling
- Waste Management
- Energy resources and systems

- Business policy and administration
- Project impact
- Public policy and environmental regulation

Environmental management is an area of study available to M.S. students residing in any of the three engineering faculties, regardless of their "major" area of interest. Required courses in management, waste management, and environmental law provide breadth and perspective for the student aspiring to managerial responsibility in public or private employment. Other courses may be recommended to enhance technical and problem-solving competencies.

Forest Engineering

Participating Faculty: LEE, PALMER

- Mechanization, automation, robotics
- Production management and efficiency
- Site modification
- Access design and construction

A modern update and broadening of the traditional areas of logging and harvesting. Emphasis is placed on engineering approaches to the design and analysis of operational systems for such activities as harvesting, construction, transportation, and land management. Graduate programs are based on a familiarity with operations research models, especially simulation techniques; mechanical and man-machine systems; biologic-geologic interactions; and various selections as needed from the array of engineering sciences.

Geo-spatial Information Systems

Participating Faculty: BROCK, DUGGIN, HOPKINS, LEE

- Spatial data acquisition
- Environmental database development
- Environmental modeling
- Site selection and facility design

This program emphasizes current approaches to using geo-spatial information systems (GIS) to better incorporate spatial data into a wide range of environmental and engineering applications. Both theoretical and applied graduate study focuses on mapping fundamentals, spatial data acquisition techniques, GIS concepts, theory of spatial analysis and modeling, and environmental applications. Additional educational opportunities include systems analysis, environmental sciences and management, automated cartography, computer science, database systems, and information management.

GIS core courses include spatial data acquisition, courses dealing with GIS concepts and theory, a GIS project, and statistics. These courses may be supplemented by many other courses and educational opportunities at ESF and Syracuse University. Graduate study may be integrated with the wide range of engineering, environmental, and resource management study areas at ESF. For example, GIS study can be expanded to hydrologic modeling, photogrammetry and remote sensing, forest management, environmental engineering, and development and location of facilities. Ample flexibility allows programs to be tailored to the interests and strengths of individual students.

Facilities are excellent and expanding, with computers at ESF and Syracuse University, including the SU Advanced Graphics Research Lab. Capabilities include numerous GIS based on a range of computing platforms and offering wide-ranging capabilities for both raster and vector processing. One of the most important GIS resources are the extensive forest properties owned and managed by ESF. These properties provide exceptional opportunities for environmental research and practice with incredible amounts of current and historical data. Related capabilities include advanced image processing systems and a wide range of photogrammetry, remote sensing, and surveying equipment and expertise. Impressive facilities for visual assessment and simulation, parallel and super computing, graphics, and cartography are also available.

Students with engineering, science, or geography backgrounds are particularly suited to this program of study. Numerous opportunities exist for research and financial support. Cooperative and contractual arrangements exist with many organizations, including local and state government agencies, federal agencies such as the U.S. Department of Agriculture, and private engineering and environmental planning firms. Employment opportunities are exceptional.

Photogrammetry and Remote Sensing

Participating Faculty: BROCK, DUGGIN, HOPKINS

- Analytical and digital photogrammetry
- Resources monitoring and assessment
- Digital image processing and classification
- Remote sensing systems analysis

This program provides opportunities for both

theoretical and applied graduate study in sensing systems and the location, measurement, analysis, and description of ground features and earth resources. Studies include in-depth coverage of photographic systems, photogrammetric measurement techniques and applications, and visual image analysis. Digital imaging systems are covered extensively, with an emphasis on earth-orbiting sensors. Advanced courses in photogrammetry and digital image analysis cover theory and techniques for enhancing and/or extracting selected features from an image. Additional courses cover the principles of remote sensing using visible, infrared, and microwave electromagnetic energy. Theoretical courses are complemented by practical exercises, courses organized to work on relevant projects, and independent study opportunities.

Unique opportunities are available to integrate photogrammetry, remote sensing and other aspects of mapping science in a coherent fashion. A core of courses in photogrammetry, remote sensing, Geospatial Information Systems, and statistics may be supplemented by many other courses and educational opportunities at ESF and Syracuse University. This flexibility allows programs to be tailored to the interests and strengths of individual students. All students obtain fundamental coverage of geometric and radiometric theory, analysis, interpretation, and applications. Further specialization through many advanced graduate courses or continued general study is then possible. Study programs may also be extended into GIS, either emphasizing spatial data acquisition for GIS databases or focusing on using a GIS database to improve remote sensing analyses.

Facilities are excellent and expanding, with a focus provided by the Mapping Science Laboratory operated by the Faculty of Forest Engineering. Additional computers are available at Syracuse University, including the SU Advanced Graphics Research Lab. Capabilities include full-featured image processing; a full range of optical/mechanical and analytical photogrammetry instruments; extensive equipment for image interpretation; sensor and atmospheric modeling systems; photographic acquisition and processing; many different GIS; and extensive surveying capacity.

Students with engineering, science, or geography backgrounds are particularly suited to this program of study. Program flexibility also allows specialization in any aspect of the above subjects from within other degree programs (e.g., forestry, landscape architecture, environmental and forest biology, etc.). Numerous opportunities exist for research and financial support. Cooperative and contractual arrangements exist with many agencies, including the U.S. Department of Agriculture, the U.S. Air Force, and NASA. Employment opportunities are exceptional.

Water Resources Engineering

Participating Faculty: HASSETT, LEE, MCCLIMANS, TULLY

- Distributed process hydrologic models
- Parameter estimation
- Real time hydrologic models
- Use of remotely acquired data in hydrologic systems

Studies deal with describing natural and manmade systems for distributing water resources. Emphasis is placed on the engineering and economic reasons for planning and for choosing between alternative solutions to water resource problems within environmental, legal, social and managerial constraints. Analysis techniques using statistics, numerical analysis and computer methodologies are normally included in individual programs. Hydrologic models are being developed as components of geographic information systems.

Paper Science and Engineering Option

Chemistry of Pulping and Bleaching

Participating Faculty: FRANCIS, JELINEK, LAI, SCHROEDER

- Reaction mechanisms and kinetics
- Applications of biotechnology
- Chemical modification in mechanical pulping
- Catalytic and activation effects

This area of study focuses on chemical relationships and reactions basic to the manufacture and bleaching of paper pulp, as well as some papermaking operations. Courses in theoretical and applied chemistry are indicated, as well as specialized courses addressed directly to pulping and bleaching. Research centers on these same topics, currently stressing new and improved processes to increase energy efficiency and reduce environmental impact. These include studies of organosolve pulping, delignification and brightening with oxygen, hydrogen peroxide and ozone, enzyme treatment of effluent streams, mechanisms of carbohydrate reactions, and photosensitization of bleached pulps.

Colloid Chemistry and Fiber Flocculation

Participating Faculty: BAMBACHT, HOLTZMAN, LUNER

- Paper sheet formation mechanisms
- Wet-end chemistry and physics
- Pulp fines characterization and distribution
- Effects of additives in fiber networks

This study area deals with colloidal phenomena in the papermaking process, in particular the interaction between fibers, fine particles, polymeric additives, and electrolytes in stock preparation and sheet formation. Student programs feature courses in colloid, polymer and physical chemistry, adding appropriate work in mathematics, statistics, and papermaking processes. Research topics fall into two categories: a) fundamental colloidal behavior of particles and b) behavior of paper stock on the paper machine. In the latter, extensive use is made of pilot plant facilities in Walters Hall. Presently under investigation are adsorption-desorption behavior of polymers in papermaking, the chemistry and physics of reactive sizes on model surfaces, and effects of turbulence on sheet formation.

Fiber and Paper Mechanics

Participating Faculty: CROSBY, EUSUFZAI, HANNA, KYANKA, LUNER, MARK, THORPE

- Fiber orientation and sheet properties
- Micromechanics theory and applications
- Effects of refining and mechanical action
- Microscopy and image analysis techniques

Mechanical behavior of fibers, paper and board, and other fiber networks and composites depends upon variables of material, process and structure at all levels, especially structural anisotropy. Recommended courses focus on mechanics of materials, physics, mathematics and statistics, microscopy, and wood and fiber properties. Research topics are basic in nature, designed to describe and model quantitatively the properties and behavior of fibers and fibrous structures. Current projects include properties of recycled fiber papers, measuring fiber stiffness via image analysis, laser speckle interferometry in strain mapping, effects of beating and fines distribution on wet-web strength, and determination of elastic constants of paper. Several members of the engineering faculty of Syracuse University collaborate closely in this work.

Process and Environmental Systems Engineering

Participating Faculty: HASSETT, HOLM, HOLTZMAN, JELINEK, RAMARAO, TOLL, TULLY

- Behavior and control of units and systems
- Reduction of air and water pollution
- Modeling and simulation of papermaking
- Processing of fibrous wastes

Process engineering links research with development, design, operation, and optimization of manufacturing methods and equipment, seeking improvement through technological innovation consistent with environmental and resource stewardship. Principles of engineering science and mathematics are applied to analysis and dynamic modeling of units and systems, with increasing use of computers in both research and professional practice. Research here includes process dynamics and control, studies of new pulping and bleaching processes, characterization and treatment of waste streams, by-product recovery, and computer simulation of paper processing systems. The extensive laboratories and pilot plant in Walters Hall are strongly supported by computing facilities and expertise on campus, including the Center for Computer Applications and Software Engineering (CASE) of Syracuse University. Appropriate advanced courses in engineering, mathematics, and computer science are available to suit individual student interests and needs.

Pulp and Paper Technology

Participating Faculty: BAMBACHT, HANNA, HOLTZMAN, JELINEK, LAI, LUNER, MARK,

- Pulping conditions and fiber properties
- Behavior of fiber fines in papermaking
- Statistical analysis of paper structure
- Recycling of papermaking fibers

Studies in this area deal closely with processes involved in the manufacture of pulp and paper. Courses concerned with this subject are central to a student's program, extended and enriched with selected courses in chemistry, polymers, chemical engineering, process control, applied mathematics, and computer applications. Current research projects include studies of pressurized stone grinding of hardwoods, chemithermomechanical pulping,

effects of wet pressing and press drying on sheet properties, pulping of tropical woods, and computer simulation and control of papermaking. Supporting this work is an experimental pulp and paper mill with two complete paper machines, a pressurized refiner and extensive auxiliary equipment.

Wood Products Engineering Option

Wood Science and Technology

Participating Faculty: KYANKA, MEYER, RESCH, L. SMITH, W. SMITH

- Adhesives and Finishing
- Drying and Machining
- Composite Materials
- Mechanical and Physical Properties

Wood science and technology includes research on all aspects of wood utilization other than engineering applications. Wood science stresses studies of wood properties important to the use of wood, or to solve problems in wood utilization by practical applications of this knowledge. The program in wood science and technology at ESF began in the early 1920s, when C. C. Forsaith initiated research relating the structure and properties of Northeastern wood species. These studies were soon expanded to include woods from across North America. As additional scientists joined the College, their research interests broadened to include timbers from around the world. The international reputation of the College's wood scientists continues to grow.

Wood Anatomy and Ultrastructure

Participating Faculty: HANNA, MEYER

- Wood formation and cell wall organization
- Cytoskeleton of plant cells
- Properties related to anatomy and ultrastructure
- Electron, light and video microscopy

This area requires that the student develop extensive background in all aspects of microscopy: light, scanning electron, transmission electron and videomicroscopy, including microtechniques for effective preparation of specimens for the appropriate instrument. Wood anatomy studies are basic to wood identification, wood utilization, and physical/mechanical properties. These studies may include woods from other continents, as indicated under the tropical timbers study area.

The field of ultrastructure is very broad with applications in many biological, chemical and materials sciences. Applied to wood, it emphasizes the sub-light microscopic structures (smaller than 0.2 micrometers) found in this natural material, either in the mature form or in its formative stages where various organelles of the living cell may be studied for their roles in producing the mature wood cell.

The behavior of wood in its many applications can be observed and explained via microscopy and related instrumentation such as EDXA (energy-dispersive x-ray analysis). State-of-the-art resources and facilities are concentrated in the Center for Ultrastructure Studies, which provides instruction and research support staff.

Tropical Timbers

Participating Faculty: MEYER

- Identification keys and systematics
- Wood properties and end use suitability
- Life zone analyses
- Expert systems

Studies in tropical timbers take many forms, depending on individual student interests. Often students from other countries bring specific problems and materials with them, so their thesis will find immediate application when they return home. The library holdings of the Tropical Timber Information Center (TTIC) and reference wood specimens of the H. P. Brown Memorial Wood Collection, both housed in the Faculty of Wood Products Engineering, are vital to this work.

Research topics may be formulated to answer questions dealing with anatomy, identification, properties or uses of various woods from around the world, again using the TTIC or Brown Wood Collection materials. These may be quite narrow such as anatomy and properties of woods from a particular region, or much broader, such as regional distribution of species and species groups based on life zone research throughout a country or other geographic area. An expert system is currently being developed to answer questions about properties and uses of woods from any part of the world. Combining published information on wood with the latest developments in computer software engineering, the knowledge-based system resulting from this study will aid researchers in answering inquiries or in suggesting new pathways for intellectual pursuit.

Wood Treatments

Participating Faculty: L. SMITH, W. SMITH, RESCH

- Wood-water relations and wood drying
- Preservative treatments
- Polymer treatments
- Wood coatings

Graduate study in the area of wood treatments allows the student to investigate the scientific basis for the improvement of wood and wood products with various treatments, which include drying, preservative treatments, and coatings. Preparation research includes graduate coursework in wood-water relationships and transport processes and additional study in areas such as wood anatomy and ultrastructure, mechanical properties, wood chemistry, wood microbiology, thermodynamics, and economics.

Current research interests include use of innovative techniques to dry wood, effect of drying method on the subsequent treatability of wood, evaluation of energy usage of several lumber drying technologies, improving wood properties with polymer treatments, and moisture migration through insulated wall structures.

Modern well-equipped laboratories are available to support these research efforts, including a sawmill, high-temperature, dehumidification, and conventional dry kilns; microprocessor data acquisition and control capability; temperature and humidity controlled environment rooms and chambers; wood permeability laboratory; pressure treating retorts; mechanical strength testing equipment; and light and electron microscopy.

Engineered Wood Products and Structures: Timber Structures Design

Participating Faculty: KYANKA, HUSSEIN

- Materials science
- Engineering mechanics
- Computer-aided design

Use of wood and wood-based components in situations where reaction to load, duration of load, and factors of safety are predicted or proscribed by engineering codes and principles. Wooden components as small as dowels or as large as bridge beams are considered, using elements of materials science, engineering mechanics and structural analysis. Basic property knowledge, employing theories of elasticity, viscoelasticity and fracture mechanics, is coupled with computer-aided design data to analyze the performance of wood and to solve application problems, such as those encountered in light-frame construction. How such factors as chemical fire retardant treatments, adhesive performance and mechanical fastener design interact with use requirements is considered. National and international design codes and their development play an important role in specifying research areas of current interest and need. Fabrication and testing of actual components is done in the Wood Products Engineering laboratory facilities.

Division of Forest Resources

BOB G. BLACKMON, Director
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Dual Undergraduate Option in Environmental and Forest Biology and Resources Management

This dual option is designed to provide students with a strong background in basic biology and forestry. In doing so it meets the core course requirements in two undergraduate curricula: environmental and forest biology, and resources management—general forestry. The dual option is part of a continuum of biology and forestry study opportunities at the College.

Dual option graduates will be highly qualified to work professionally in forested ecosystems. The breadth of training received will prepare them for careers in forestry, forest biology, and other aspects of environmental science in the federal, state, and private sectors. Exposure to diverse courses and extensive field experience enhances their employment opportunities in multidisciplinary programs that are characteristic of contemporary approaches to natural resource management and other professions that address environmental problems.

The dual option requires a minimum of five semesters at the upper division level. Six semesters are often required for those who lack appropriate lower division courses, or who wish to develop specific professional interests in biology or forestry. Students need to be aware of the financial aid implications of one or two additional semesters, especially with respect to the New York State Tuition Assistance Program (TAP), and plan accordingly, starting with the pre-ESF (lower division) semesters. TAP allows a student eight semesters of payments for an undergraduate degree. Dual students may exceed this number and lose a semester(s) of TAP aid if previous payments exceed eight.

A total of 147 credit hours, 62 prior to matriculation, is required. In addition to the 58 credit hours of upper division core courses listed below, 6 of the elective credit hours must be in plant science, 6 in animal science, and 9 credit hours in upper division (300 or above) biology courses, exclusive of the summer camp experience.

There is less opportunity for free electives in the dual option than in the two curricula which it combines. It is recommended that elective requirements in plant science and animal science address critical support areas such as forest pathology, plant ecology, fish and wildlife management, and entomology. Similarly, forestry electives in silviculture, hydrology, or tree improvement are examples of opportunities in important forestry support areas. Students with specific career and professional goals should make them known to their advisor as early as possible so that proper elective course selections can be made. Course selection is made after consultation with each of two advisors; one from the Faculty of Environmental and Forest Biology and one from the Faculty of Forestry.

There is flexibility in the structure of the curriculum. For example, the required Summer Program in Field Forestry, at Wanakena, may be taken prior to the junior year. This permits courses at the Cranberry Lake Biological Station to be incorporated (see p.74).

To facilitate transfer at the junior level, it is important that students satisfy the lower division course requirements prior to matriculation at the College of Environmental Science and Forestry.

Students entering at the junior level should

have successfully completed a minimum of 62 credits which include:

Lower Division Courses

Students entering this program through the freshman admissions option should refer to page 56.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
General Botany and Zoology **OR** General Biology with Laboratory	8
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory[1]	4
General Physics with Laboratory[1]	4
Calculus [1]	3
One additional course with laboratory in either chemistry or physics, or a course in calculus or linear algebra	3-4
English	6
Fundamentals of Sociology **OR** Psychology	3
Political Science (U.S. Institutions)	3
Microeconomics	3
Computer Applications	3
Electives (Social Sciences/Humanities)	9-10
Electives (Biology)	4-5
Total minimum lower division credits	61-64

Upper Division Courses

Junior Year

			Credit Hours
Fall Semester	ESF 332	Seminar for New Transfer Students	0
	EFB 320	General Ecology	3
	EFB 325	Cell Physiology	3
	Electives[2]		9-10
			15-16
Spring Semester	APM 391	Introduction to Probability and Statistics	3
	EFB 307	Principles of Genetics	3
	EFB 308	Genetics Lab	1
	FOR 360	Principles of Management	3
	Electives[2]		6
			16

Summer Program in Field Forestry[3]

FOR 301	Field Dendrology	1.0
FOR 302	Forest Surveying and Cartography	2.5
FOR 303	Introduction to Forest Resource Measurements	3.5
FOR 304	Introduction to Forestry	1.0
		8.0

Senior Year

			Credit Hours
Fall Semester	FOR 305	Forestry Concepts and Applications	1
	FOR 322	Forest Resource Measurements	2
	FOR 331	Forest Influences	3
	FOR 332	Silvics	3
	FOR 333	Silvics Laboratory/Practicum	1
	FOR 334	Silviculture	4
	FOR 345	Soils	3
			17
Spring Semester	FOR 363	Management Models	3
	FOR 465	Natural Resource and Environmental Policy	3
	Electives [2]		9
			15

Fifth Semester

		Credit Hours
APM 492	Forest Biometrics	3
FOR 400	Forest and Resource Economics	3
FOR 470	Management of the Forest Enterprise	3
Electives [2]		6
		15
	Total minimum upper division credits	86-87

A total of 147 credit hours is required to complete the B.S. degree in the dual program of environmental and forest biology and resources management.

[1] Students may be admitted with deficiencies in these subject areas. However, deficiencies must be removed as early as possible in the student's program. Students are strongly encouraged to pursue further coursework in these and related areas in consultation with their advisors.

[2] Electives taken throughout the curriculum must include at least 9 hours of social science/humanities; 1 course from each of groups A and B (A: EFB 336, Dendrology or EFB 340, Forest and Shade Tree Pathology or EFB 326, Diversity of Plants; B: EFB 352, Elements of Forest Entomology or EFB 351, Principles of Forest Entomology or EFB 303, Introductory Environmental Microbiology or EFB 355, Invertebrate Zoology); a minimum of 6 credit hours each of animal [courses numbered from ()51 to ()95] and plant science [courses numbered from [()26 to ()50; see page 126]; a protection course (entomology or pathology if not chosen from the A and B list; otherwise, this becomes a biology upper-division elective); and 9 hours of upper-division (300 level or higher) biology.

[3] The required summer program in field forestry may be taken prior to the junior year, permitting courses at the Cranberry Lake Biological Station to be taken in the summer.

The Faculty of Chemistry

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The academic program in chemistry enables the student to develop not only an understanding of chemical phenomena, but also an appreciation for chemistry that can link it to the biological and applied sciences. Programs include courses in traditional areas of chemistry, with additional study in fields pertaining to environmental science and forestry. This broad spectrum of academic offerings is possible through close cooperation with Syracuse University, where a wealth of accessory courses at both the undergraduate and graduate levels are available. Emphasis on the investigative function of chemical science is manifest in the wide array of ongoing research projects within the department.

Undergraduate Program

The Faculty of Chemistry offers three options leading to the bachelor of science degree: biochemistry and natural products, environmental chemistry, and natural and synthetic polymer chemistry. Each option offers an advanced core of studies beyond the basic courses of the classical undergraduate chemistry curriculum. Additionally, students in all options, by selecting proper electives, may be certified on graduation as having completed an American Chemical Society approved curriculum. All options are excellent grounding for professional work at the B.S. level or for advanced graduate study.

Biochemistry and Natural Products

Participating Faculty: BOYER (Plant and Algal Biochemistry), LALONDE (Organic and Natural Products Chemistry), TANENBAUM (Biochemistry and Microbiology), TIMELL (Wood Chemistry), F. X. WEBSTER (Organic Chemistry and Chemical Ecology)

Biochemistry and Natural Products stresses a chemical approach to problems in the life and health sciences. After obtaining a strong foundation in analytical, physical and organic chemistry, these studies are supplemented by advanced courses in natural products chemistry, wood chemistry, spectroscopy, and biochemistry. Professional electives in botany, chemical ecology, genetics and molecular biology provide the background for interactions in the life and health sciences. Research areas include the elucidation of chemical signals by which organisms communicate with each other, the role of trace metals in the growth of microorganisms, and the origin and function of biologically active natural compounds.

Environmental Chemistry

Participating Faculty: BOYER (Environmental Biochemistry), JOHN P. HASSETT (Environmental Chemistry), DAVID L. JOHNSON (Environmental Chemistry), KIEBER (Environmental Chemistry and Oceanography), LALONDE (Chemical Toxicology), TANENBAUM (Biotechnology)

Environmental chemistry stresses applications of fundamental chemical principles to describe and predict behavior of chemicals in the environment. Courses in air and water chemistry are supplemented by advanced courses in analytical, physical, or organic chemistry. A wide variety of courses in areas such as biology, engineering, geology, and environmental policy are also available. Research areas include phase-partitioning of organic compounds in water, characterization of particles in air and water, aqueous photochemistry, sampling techniques for organic compounds, biological alkylation of metals, analysis of organic particles in water, characterization of natural organic matter in soil and water, and behavior of major ions and nutrients in water.

Natural and Synthetic Polymer Chemistry

Participating Faculty: CABASSO (Polymer Chemistry and Membrane Science), CALUWE (Organic Chemistry, Synthetic Polymer Chemistry), SARKO

(Physical and Biopolymer Chemistry), SMID (Organic and Physical Polymer Chemistry), KENNETH J. SMITH, JR. (Physical and Theoretical Polymer Chemistry), TANENBAUM (Biopolymers), TIMELL (Wood Chemistry), WINTER (Physical and Biopolymer Chemistry)

Undergraduates in the natural and synthetic polymer option take advanced courses in mechanisms of polymerization and polymer synthesis, in the physical properties and characterization of polymers, as well as in the laboratory techniques of polymer synthesis and characterization. In addition, two semesters of wood chemistry provide a solid background for chemists planning careers in paper, textiles, membranes, and related areas. Biochemistry is an appropriate elective for students interested in the growth of biotechnologies while environmental chemistry complements this program for students interested in working on problems of chemical waste. The program offers an excellent background both for direct entry into industrial chemistry and graduate study in areas such as chemistry, biotechnology, or polymer science. More than 50 percent of all practicing chemists work on problems involving polymer chemistry.

Lower Division Courses

Students entering this program through the freshman admissions option should refer to page 56.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
General Biology with Laboratory	8
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory	8
Physics with Laboratory	8
Economics	3
English	6
Language, Literature or Communication	6
Electives	12-15
Mathematics *	6-9
Total minimum lower division credits	68

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*Mathematics through integral calculus. An additional mathematics course beyond integral calculus is required for the B.S. degree.

Upper Division Courses

Junior Year — *Credit Hours*

First Semester	ESF 332	Seminar for New Transfer Students	0
	FCH 325	Organic Chemistry III	4
	FCH 380	Analytical Chemistry I.	3
	FCH 360	Physical Chemistry	3
	Professional Elective [1]		2-4
	Elective		3
	FCH 496	Safety and Orientation (required audit)	1
			16-18
Second Semester	Math or Elective[2]		3
	FCH 381	Analytical Chemistry II.	3
	FCH 361	Physical Chemistry	3
	CHE 357	Physical Chemistry Laboratory	2
	FCH 384	Spectrometric Identification of Organic Compounds	2
	Professional Elective[1]		2-3
	Elective		3
			18-19

[1] A two-semester sequence of professional electives to be taken starting in the junior year should be chosen from the current list of courses, providing a wide range of study in biology, chemistry, ecology, forestry, environmental law, mathematics, geology, physics, biophysics, various engineering disciplines, and others. A copy of this list is available in 228 and 314 Baker.
[2] One course of mathematics or applied mathematics beyond integral calculus is required.

Biochemistry and Natural Products Chemistry Option

Senior Year — *Credit Hours*

First Semester	LIB 300	Library Research	1
	FCH 495	Introduction to Professional Chemistry	1
	FCH 571	Wood Chemistry I	2
	FCH 530	Biochemistry I	3
	FCH 531	Biochemistry Laboratory	2
	Professional Elective/Elective[1]		3
	Elective		3
			15
Second Semester	FCH 498[2]	Introduction to Research	5
	FCH 497	Undergraduate Seminar	1
	FCH 532	Biochemistry II	3
	FCH 573	Wood Chemistry III	2
	Elective		3
	Elective[3]		3
			17
	Total minimum upper division courses		66

[1] Introduction to Polymer Science, FCH 550 (3 credit hours) is suggested.
[2] Petition by student to the Faculty for replacement of this requirement will be considered to allow time for special interest.
[3] Topics in natural products chemistry, FCH 524 (3 credit hours) is suggested.

A total of 134 credit hours is required to complete the B.S. degree in chemistry with the biochemistry and natural products option.

Environmental Chemistry Option

Senior Year — *Credit Hours*

First Semester	LIB 300	Library Research	1
	FCH 495	Introduction to Professional Chemistry	1
	FCH 510	Environmental Chemistry I	3
	FCH 515	Methods of Environmental Chemical Analysis	3
	Chemistry Elective		3
	Professional Elective/Elective[1]		3
	Elective		3
			17
Second Semester	FCH 498[2]	Introduction to Research	5
	FCH 511	Environmental Chemistry II	3
	FCH 497	Undergraduate Seminar	1
	Electives		6
			15
	Total minimum upper division credits		66

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[1]Biochemistry I, FCH 530 (3 credit hours) is suggested.

[2]Petition by student to the Faculty for replacement of this requirement will be considered to allow time for special interest.

A total of 134 credit hours is required to complete the B.S. degree in chemistry with the environmental chemistry option.

Natural and Synthetic Polymer Chemistry Option

Senior Year — *Credit Hours*

First Semester	LIB 300	Library Research	1
	FCH 495	Introduction to Professional Chemistry	1
	FCH 550	Introduction to Polymer Science I	3
	FCH 551	Polymer Techniques	2
	FCH 571	Wood Chemistry I	2
	Professional Elective/Elective[1]		3
	Elective		3
			15
Second Semester	FCH 498[2]	Introduction to Research	5
	FCH 552	Introduction to Polymer Science II	3
	FCH 497	Undergraduate Seminar	1
	FCH 573	Wood Chemistry III	2
	Electives		6
			17
	Total minimum upper division credits		66

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[1]Biochemistry I, FCH 530 (3 credit hours) is suggested.

[2]Petition by the student to the Faculty for replacement of this requirement will be considered to allow time for special interest.

A total of 134 credit hours is required to complete the B.S. degree in chemistry with the natural and synthetic polymer option.

Graduate Programs

Recent years have seen profound advances in the fundamental knowledge of chemical areas that have special significance for forestry and the environment. The following research areas have received active attention by both faculty and graduate students in the programs: polymer chemistry and physics; wood chemistry; environmental chemistry; biochemistry; chemistry of natural products, including ecological chemistry; and materials sciences.

Requirements for a master of science or doctor of philosophy degree in chemistry include a research thesis, along with an appropriate program of courses at the College and at Syracuse University. Master's and doctoral students must complete a minimum of 18 credit hours and 30 credit hours of graduate level coursework, respectively.

Current research projects encompass polymer chemistry, membrane science, and wood chemistry; biochemistry and microbiology; organic chemistry of natural products and chemical ecology; environmental chemistry of the air, water, and solids.

Biochemistry

Graduate studies in biochemistry reflect the College's interests in microbial, insect, and plant biochemistry. After completing a one year sequence in general biochemistry, students select advanced courses from a range of offerings in chemistry, organismal biology and molecular biology. Advanced courses in biochemistry are available both at ESF and Syracuse University.

A wide variety of research opportunities are available to plant physiology. Areas of faculty interest range from biotechnology to plant physiology. Selective research topics include: The use of microorganisms for the production of speciality chemicals including polysaccharide interconversions (Tanenbaum); the application of bacterial and fungal enzymes in the bioremediation of environmental problems (Tanenbaum); heavy metal cycling in natural systems (Boyer); microbial and algal production of biologically active natural products and their importance in cell biology (Tanenbaum, Boyer, LaLonde); chemical communication between organisms (Webster); marine algal toxins (Boyer); and trace metal/nitrogen physiology of plants and algae (Boyer). Opportunities for research in other areas (e.g., molecular biology) are also available in collaboration with faculty outside the Chemistry Faculty.

Environmental Chemistry

Thesis research for graduate students in environmental chemistry is central to their program of studies and includes both experimental and theoretical considerations. Frequently, the problems to be addressed are transdisciplinary in nature. Thus coursework is carefully selected from areas of chemistry, biology, geology, engineering, mathematics and computer science in order to support the student's particular research needs in conjunction with fieldwork and laboratory experiments. Special topics in analytical-environmental chemistry or for methods development are often arranged.

The environmental chemistry faculty currently have active research interests in both aquatic and atmospheric systems. These include: the thermodynamics and kinetics of binding hydrophobic organic compounds by dissolved humic substances in water, the development of gas partitioning techniques for measuring the extent to this binding in both laboratory and field environments, and the characterization of poorly understood humic substances by techniques such as NMR (Hassett); the study of chlorinated hydrocarbons in the Niagara River-Lake Ontario-St. Lawrence River system, and their interaction with sediments, dissolved substances and organisms (Hassett); the exchange of chlorinated hydrocarbons and other trace organics between aqueous and atmospheric phases in the environment (Hassett, Kieber); understanding the role of organic matter in a variety of atmospheric, aquatic and sedimentary processes (Kieber, Hassett, Johnson); the development of probe systems to study free radical processes and photochemical transformations of dissolved organic matter in natural waters (Kieber); understanding the dynamics of the oceanic carbon cycle and the importance of sunlight-driven photochemical transformations of organic matter in seawater (Kieber); the application of computer assisted SEM/EDXA to individual particle analysis in atmospheric, aquatic and suspended sediment samples (Johnson); the dynamics of calcium carbonate precipitation in hard water lakes (Johnson, Hassett); the biomethylation of As, Sn, and Hg in soil/plant systems (Johnson).

Organic Chemistry of Natural Products

Graduate students in organic chemistry of natural products take a one year course sequence in mechanistic organic chemistry and another in synthetic organic chemistry. Additionally, one semes-

ter courses are required in advanced physical chemistry and the organic chemistry of natural products. Courses in biochemistry, inorganic chemistry, statistics and specialized courses in chemistry or biology may be arranged and selected by the student in consultation with faculty.

Research in the field or organic chemistry of natural products takes three paths. These paths are: The isolation and characterization of new natural substances; the synthesis of new or improved syntheses of better known natural substances; and the study of the relation of molecular structure to biological response. Chemical research in each of these areas is coupled to biological testing. Research involving isolation and synthetic chemistry requires the student to develop expertise in separation techniques, such as the several methods of chromatography, and spectrometric identification of molecules. Successful investigation in structure/activity relationships requires the student become familiar with statistical methods of analysis. Current topics of interest to the natural products faculty are the following: Structure and function of natural metal chelators (Boyer); marine and freshwater algal toxins (Boyer); synthesis and structure/activity relationships of nonvolatile, aquatic genotoxins (LaLonde); synthesis of natural products employing sulfur chemistry (LaLonde); isolation and identification of insect and mammalian pheromones and other semiochemicals such as alleomones and kairomones (Webster); and synthesis of new natural products (semiochemicals) with particular emphasis on stereochemistry (Webster).

Polymer Chemistry

Graduate students in polymer chemistry select their courses from a range of offerings in chemistry, chemical engineering, mathematics, physics, and other appropriate areas. These courses will include either the one year sequence in physical or organic chemistry of polymers and such additional courses as the student and advisor consider necessary. Special topics in a spectrum of polymer fields are offered or can be arranged in consultation with the faculty.

Research is an essential component of any graduate degree program in polymer chemistry. Current topics of research interest within the polymer faculty include the following: preparation, modification, and technology of polymeric membranes (Cabasso); preparation, properties, and applications of radiopaque polymers (Cabasso, Smid); inorganic polymers (Smid, Cabasso); novel methods of cellulose and cellulosic modification (Caluwe); diffraction methods, NMR, and dynamic molecular modeling approaches to polymer structure determination and prediction (Sarko, Winter); catalysis and mechanisms of polymerization, chemistry of free radicals, radical ions and charge transfer processes (Smid); ion-binding, polyelectrolytes, conductivity, properties of ionic solutions in non-aqueous media (Smid); achieving ultimate properties in polymer materials (Smith); thermodynamics and statistical mechanics of polymer systems (Smith); biomass conversion to industrial polysaccharides (Tanenbaum, Winter).

Research Laboratories

Graduate research laboratories in the Hugh P. Baker Laboratory are well equipped for polymer studies, chemical, and biochemical research. Spectroscopic facilities include ICP, IR, FTIR, GC/MS, UV/VIS, fluorimetric, liquid and solid-state multinuclear NMR, and ORD/CD spectrometers. Ultrastructure study facilities include X-ray diffraction equipment and several scanning and transmission electron microscopes. Chromatographic equipment includes instrumentation for analytical and preparative liquid and gas chromatography. Baker Laboratory is fully equipped for the use of radioisotopes in research including a separate radioisotopes lab. Liquid and solid scintillation counters, a multichannel analyzer, and a cobalt-60 irradiation source are available. Other facilities include DSC, torsion pendulum, membrane and vapor phase osmometry, solution and solid-state light-scattering photometers, and a computational environment including PS2 and MAC PCs, work stations and network access to mainframe computing on IBM 3090, VAX 8820 and SPARC 4/490 platforms.

The Faculty of Environmental and Forest Biology

ROBERT L. BURGESS, Chair
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Programs in environmental and forest biology provide students with a firm foundation in basic biology, ecosystem dynamics, and environmental science. They encompass a variety of interconnected disciplines concerned with living systems, and treat not only the form, function, and evolution of organisms, but their life requirements, tolerances, and interactions that are central to the stewardship of renewable natural resources and the maintenance of environmental quality.

The critical importance modern society places upon the utilization of natural resources and the quality of our environment adds new and increasingly diverse dimensions to the services a well-trained biologist can render. The faculty is committed to meet this dynamically changing array of opportunity through coursework enriched by an active program of research that focuses upon upper-level undergraduate and graduate study. Through the addition of selected electives to a required core, undergraduates may focus their program toward a special biological field (see p. 74) or toward future graduate study. Graduate students may develop a course of study under the guidance of a major professor and graduate committee within any of several areas of study (see p. 77).

The academic programs stimulate interest in the recognition and understanding of plants, animals, and protists, and deal with dynamic changes in biological systems in the context of the broad fields of ecology, physiology, genetics, and evolution.

Undergraduate Program

The curriculum for the bachelor of science degree is built around a core of required courses which provide the student with a general education, a basic background in the principles of the biological and the physical sciences, and an orientation to natural resources. Its design develops breadth in biology as well as depth in a special biological field. Although individual course selections may vary, all students major in environmental and forest biology and each, with an assigned advisor, develops a special plan of study.

Lower Division Courses

Students entering this program through the freshman admissions option should refer to page 56.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
General Botany and Zoology OR General Biology with Laboratory	8
General Chemistry with Laboratory, 2 semesters	8
Organic Chemistry with Laboratory, 1 semester*	4
Physics with Laboratory, 1 semester*	4
Calculus, 1 semester*	3-4
One additional course with laboratory in either Chemistry, or Physics, or a course in Calculus, or Linear Algebra, 1 semester	3-4
English	6
Social Sciences, Humanities**	9
Electives (recommended in Biology, if available)	13-15
Total minimum lower division credits	60

*Students are strongly encouraged to pursue further coursework in these and related areas in consultation with their advisors.
**A course in technical writing and/or speech is highly recommended as part of the social science humanities group.

A dual-major program is available that meets the undergraduate requirements of environmental and forest biology and of resources management (see p. 63).

In addition to the core courses and Summer Field Experience specified below, at least 21 hours in biology at the 300 level or above must be completed. Of these, at least 15 must be from courses at ESF. Six of the 21 credit hours must involve coursework in plant science [courses numbered from ()26 to ()50] and six in animal science [courses numbered from ()51 to ()95; see page 126]. The balance of the required hours is chosen in consultation with the advisor.

Summer Field Experience

Between the junior and senior years, each student completes a minimum of five semester credit hours (or equivalent) during residence in an approved academic program in field biology. This requirement is usually met by the appropriate selection of courses at Cranberry Lake Biological Station (CLBS) where courses are offered during

Upper Division Courses

Junior Year

			Credit Hours
First Semester	ESF 332	Seminar for New Transfer Students	0
	EFB 320	General Ecology	3
	EFB 325	Cell Physiology	3
	Electives		9
			15
Second Semester	APM 391	Introduction to Probability and Statistics	3
	EFB 307	Principles of Genetics	3
	EFB 308	Genetics Laboratory	1
	Electives		8
			15

Summer Field Experience—Must be met as described on page 73 5

Senior Year

		Credit Hours
First Semester	Electives	15
Second Semester	Electives	15

Electives *must* include at least one course from each of groups A, B, and C.

A	B	C
Elements of Entomology	Dendrology	Soils
Principles of Entomology	Diversity of Plants	Geology
Invertebrate Zoology	Forest & Shade Tree Pathology	Earth Science
Introductory Environmental Microbiology		Climatology
		Meteorology

Additionally, students must take a minimum of six credits of animal and six of plant science that may include courses from lists A and B not used above.

Total minimum upper division credits 65

A total of 125 credit hours is required to complete the B.S. degree in environmental and forest biology.

each of two sessions. Earning five credits at one session satisfies the requirement; any additional courses taken in the other session count as elective credits.

Alternatively, other biological field stations may be attended to earn the minimum five semester hours credit (or equivalent). Petitions requesting this alternative must include course descriptions and the program contemplated and be submitted to the curriculum director at least one month prior to the end of the spring semester preceding the summer program. A current file of alternative stations and course descriptions is maintained by the director of the Cranberry Lake Biological Station.

Cranberry Lake Biological Station

Cranberry Lake and its environs are ideally suited for an advanced biology summer program. The surrounding topography is rolling hill and lake country dotted with numerous small ponds, closed bogs, and stream drainages. The lake is the third largest body of water in the Adirondacks. Because 80 percent of the shoreline is in State ownership, the lake remains unspoiled by recreational developments and pollution problems. Much of the original forest cover in the region was harvested 80-100 years ago; today a rich variety of community types occupies those sites as the vegetation reverts to natural conditions. The remaining virgin forests also provide students with many examples of stable ecosystems, each type reflecting the particular environmental conditions controlling forest development. A wealth of wildlife parallels the variety of cover types. The area provides easy access to a wide range of additional ecosystems ranging from bog to alpine vegetation.

Facilities include four classroom-laboratories; dining facilities for 120; faculty quarters and cabins; an administration building; 12 cabins housing 6-8 students each; a recreation hall; and several smaller, supporting buildings.

The program extends through June and July, divided into two sessions. Courses are designed to emphasize and effectively utilize the unique nature of this Adirondack setting, and all involve field trips each day into the surrounding forest and aquatic ecosystems.

Information about the summer program, including courses and fees, may be obtained from the Director, Cranberry Lake Biological Station, State University of New York College of Environmental Science and Forestry, Syracuse, New York 13210.

Electives and Elective Concentrations

The curriculum meets general requirements for graduate study and for a wide range of federal, state, municipal, and private biology positions. Those training for biological positions in federal and state service should review civil service publications and become familiar with specific course requirements early enough to make timely elective choices. Students are urged to use some elective time to enhance their communications skills. Courses in technical writing, applied communications or a foreign language (as approved by their faculty advisor) are especially useful.

Listed below are 11 elective concentrations that focus on specialized fields of biology. Further information on these can be found in the Career Guide Handbook for Biologists available from the Curriculum Director.

Ecology. The purpose of the undergraduate elective concentration in ecology is to give students a basic knowledge of the relations of organisms to their environment and how these affect their distribution and abundance. There are four major areas in ecology: organismal ecology, population-evolutionary ecology, community ecology, and systems ecology. Undergraduate students choose courses from at least two of these four areas to obtain training beyond that of General Ecology. The practical and theoretical application of ecology is emphasized through courses at both ESF and Syracuse University as well as at the Cranberry Lake Biological Field Station. Students in environmental and forest biology are encouraged to select courses compatible with their interests and educational goals. Examples of possible course selections and a listing of ecology courses are given below.

Students in this concentration will have an excellent background to pursue graduate work in ecology and to develop ecological expertise. Preparation in ecology will serve students who pursue further training or employment in those areas of research, teaching, or management which apply ecological principles.

In addition to core biology courses, students in the ecology concentration take one semester of Seminar in Ecology (EFB 497), plus at least one course from two of the following four categories:

1. Organismal Ecology

EFB 445 Plant Ecology
EFB 448 Physiological Ecology of Plants
EFB 480 Principles of Animal Behavior
EFB 489 Animal Physiology
EFB 505 Microbial Ecology

EFB 554 Aquatic Entomology
BIO 427 Physiological Plant Ecology

2. Population/Evolutionary Ecology
EFB 309 Introduction to Quantitative and Population Genetics
EFB 410 Concepts in Evolution and Biological Systematics
EFB 515 Population Ecology
BIO 343 Population Biology
BIO 401 Evolution and Population Genetics[1]
BIO 402 Demography and Behavioral Ecology[1]
BIO 410 Seminar in Population Ecology
BIO 431 Population Genetics

3. Community Ecology
EFB 488 Ecology of Adirondack Fishes
EFB 578 Terrestrial Community Ecology
BIO 403 Physiological and Community Ecology[1]

4. Systems Ecology (Ecosystem, Landscape, Global)
EFB 516 Ecosystems
EFB 518 Systems Ecology
EFB 542 Freshwater Wetland Ecosystems

[1]Tutorial

Entomology. Insects play significant roles, both beneficial and detrimental, in their interactions with people, natural resources, and environment. Courses enable a student to fulfill requirements of civil service and a variety of other employers. Program strengths are in forest entomology, medical entomology, pest management, and environmental toxicology.

Environmental Microbiology. Microbiology is a dynamic and exciting science that deals with bacteria, molds, algae, yeasts, protozoa, rickettsiae, and viruses: their roles in industry, disease, the environment, and everyday life. Careers in microbiology are available throughout the public and private sectors, and related to many different professions and industries.

Fish and Wildlife Biology and Management. A basic and applied program in fish and wildlife biology, including management and behavior, is provided for students whose objectives are to develop professional skills in the biology and management of these natural resources. This program offers a broad education in the biological sciences with a strong foundation in ecology. Course selections are readily tailored to meet certification requirements for The Wildlife Society and the American Fisheries Society. Specialized and advanced courses are offered in fishery biology, wetland ecology, wildlife ecology and management, limnology, habitat analysis, and wildlife techniques.

Forest Pathology and Mycology. Protection of vascular plants and wood products from invading organisms, such as fungi, is basic to forest productivity, effective wood product use, and the maintenance of environmental quality. Program strength is in the ecological, physiological, genetic, and environmental aspects of disease. Students may train for positions in forest pathology, mycology, plant quarantine, or diagnostic laboratories. Opportunities for employment exist with federal, state, and private agencies.

Pest Management. Modern control of insects and disease dictates practices appropriate to maintaining acceptable environmental quality. Through proper course selection, students are able to achieve training in wise selections of methods for an integrated approach to pest management. Training thoroughly prepares students for state examinations required for pesticide applicator's certification.

Plant Physiology. Plant physiology, part of the broader science of botany, concerns the life processes that occur in plants. Career opportunities are available in federal, state, and local governments through their extensive testing and monitoring programs. Additionally, positions are available in agriculture and forestry concerning pathogenic microorganisms and physiological mechanisms of infection.

Plant Science. Students may prepare for a wide variety of opportunities in the botanical professions. Essential to understanding plants are their biochemical and physiological processes; their interactions with the environment and with one another; with animals and other organisms; their genetic makeup, evolution and classification. Requirements may be satisfied for technical positions in areas such as botany, plant ecology, tree genetics, plant physiology, horticulture, tree maintenance, or plant quarantine.

Pre-Medical Science. Completion of all core and elective requirements in environmental and forest biology will prepare students for application to medical schools of their choice. Premedical programs are not formally structured curricula, but most often consist of opportunity to take necessary coursework in biology, chemistry,

mathematics and physics that will prepare students for required admission testing procedures. Environmental and forest biology offers an abundant array of courses and opportunities for students interested in careers as physicians or in veterinary medicine.

Science Education. Through special arrangements with Syracuse University, students in environmental and forest biology can couple a strong program in basic biological sciences with necessary education courses required to qualify for certification as science teachers in grades 7-12 under New York State regulations. Advisors will guide students interested in this program to the appropriate coursework and the mechanisms required to successfully complete a program in science education.

Zoology. A broad program is provided for the student whose objectives are to go on for graduate study or to further training in physiology, soil invertebrate ecology, animal behavior, or animal ecology. Some opportunities with federal and state agencies are available at the baccalaureate level.

Internship Program

A variety of internships are available, either in the summer or one semester of the academic year. These are arranged in cooperation with the student's advisor. Agencies actively involved with the internship program include the U.S. Fish and Wildlife Service, New York State Department of Environmental Conservation, and the National Park Service.

Accelerated Five-Year BS/MS Track In Plant Biotechnology

Biotechnology, the use of biological techniques and processes to provide for the well-being of humankind, has arisen with the recent expansion of our understanding of cell biology that permits the manipulation of molecules involved in reproduction and specific biological systems. We now have the ability to design better biological agents and organisms for human benefit. The undergraduate component of this integrated course of study prepares students not only for graduate work in plant biotechnology, but also for career opportunities available at the baccalaureate level.

The undergraduate track includes all requirements for the bachelor of science degree in environmental and forest biology. In addition, courses in plant science, chemistry and biochemistry, and introductory courses in genetic engineering and tissue culture technology are required.

The five-year accelerated bachelor of science/master of science track in plant biotechnology is an opportunity within the graduate program in environmental and forest biology. Admission to the M.S. degree is open to all students with strong backgrounds in biology and chemistry. Students completing the undergraduate component at ESF must satisfy the normal graduate admission requirements of the College.

The accelerated M.S. program requires a minimum of one year plus two summers of full-time study. Students will usually undertake the thesis/project program alternative. Course requirements include plant recombinant DNA technology, genetic engineering and biotechnology; plant virology; seminars and laboratory techniques. Graduates will be well-prepared for professional careers as highly trained technical specialists, in research associated with industrial and governmental laboratories, or for continuing graduate study in a Ph.D. program.

Graduate Program

The graduate program in environmental and forest biology is organized in eight interdependent areas of study that provide comprehensive coverage within specific interest areas. Faculty in each area define the scope of subject matter, recommend acceptance of students and guide them in a course of study. It is opportune for students to develop a degree of specialization in at least one large taxonomic group (e.g., fungi, plants, vertebrates, insects) to assure a useful mix of talents.

Most students seeking the M.S. degree include a research thesis and its defense (see p. 33). There also is a program alternative to earn the degree with 42 hours of coursework specified by the student's advising faculty. All who seek the Ph.D. must include original research and a thesis or its equivalent in the form of refereed publications.

The center of activity is Illick Hall, with laboratories, classrooms, controlled spaces, and equipment in a modern building in which 8,000 square meters of working space is available for graduate study and research. Laboratories, many of them temperature and temperature-humidity controlled, and one sound-controlled, are provided for study and research in plant development, physiology, tissue culture, molecular biology, biochemistry and toxicology, ecology, and animal behavior. An herbarium, mycological collections, insect and other invertebrate collections, and the Roosevelt

Wildlife Collection of vertebrates are maintained as resources for the academic program. Eight rooftop glasshouse units, three of them air-conditioned and one incorporated into a five-room indoor-outdoor insectary, are important to the full array of interests in plant science and plant-animal interactions.

Also available to students and faculty is a variety of sophisticated instrumentation: convenient access to a computer center; radioisotope counting equipment, including liquid scintillation spectrometer and Cobalt-60 source; diverse analytical equipment and measuring devices; gas-liquid chromatography; and a comprehensive analytical expertise. The N. C. Brown Center for Ultrastructure offers coursework and research in scanning and transmission electron microscopy.

Supportive to the program are the academic resources, including courses, of Syracuse University, SUNY's Health Science Center and the several campus facilities described elsewhere in this catalog. Our students also participate in courses and utilize faculty and facilities at Cornell University and several SUNY campuses in cooperative exchanges.

Excellent field sites and facilities are available for research in all aspects of the program. In addition to the College's several campuses and field stations that offer a broad diversity of forest types, sites, and conditions, there are New York State Department of Environmental Conservation lands, the Montezuma National Wildlife Refuge, the Adirondack Mountains, and the transition zones near Lake Ontario, Oneida Lake, and Cicero Swamp. These areas offer a variety of habitat diversity from highlands to aquatic-terrestrial zones. The ponds, streams, and lakes in Central New York and the St. Lawrence River are regularly used by graduate students in aquatic ecology, fishery biology, and ecosystem science.

Further academic advantages stem from the urban setting of the Syracuse campus. Nearby Onondaga Lake is a prominent feature that serves as a focus for many research and teaching activities. The Greater Syracuse area provides a convenient laboratory for studies basic to urban ecology: urban wildlife, the growth and protection of woody vegetation, greenspace maintenance, the utilization of waste beds for plant growth, the detoxification of pollutants, and the restoration of terrain stripped of vegetation. Disposal of industrial and human wastes requires deeper understanding of the role of plants, animals and microorganisms in the biodegradation of organic matter. The conversion of organic materials into useful fuel, into additives for plant growth, or into protein feeds for domestic animals are stimulating topics.

Eight areas of study are available: ecology, entomology, environmental physiology, fish and wildlife biology and management, pathology and mycology, plant science and biotechnology, and soil ecology. One, chemical ecology, is shared with the Faculty of Chemistry. Additional information on each of these areas of study is available by telephone or written request to any of the professors listed.

Areas of Study

Ecology

ALEXANDER (Vertebrates, Wetlands), ALLEN (Forest Insects), BALDASSARRE (Wetlands), BROCKE (Wildlife, Bioenergetics), BURGESS (Forest Ecology), CHAMBERS (Wildlife), DINDAL (Invertebrates, Soil Ecology), HALL (Systems Ecology), KURCZEWSKI (Insect Behavior), LEOPOLD (Dendrology, Community Ecology), MITCHELL (Biogeochemistry), MÜLLER-SCHWARZE (Vertebrate Behavior), NAKAS (Microbiology), PORTER (Vertebrate Ecology), RAYNAL (Physiological Ecology, Demography), RINGLER (Aquatic Ecology, Fish Behavior), SCHAEDLE (Plant Nutrition), SHIELDS (Vertebrate Behavior), SIMEONE (Forest and Wood-boring Insects), STEWART (Aquatic Ecology), TURNER (Physiological Ecology), VANDRUFF (Wildlife), WERNER (Limnology)

Adjunct Faculty: CHEPKO-SADE (Primate Ecology)

This integrative study area allows students to investigate the relationships of organisms to their environment and those factors which affect their distribution and abundance. Both the practical and theoretical applications of ecology are emphasized through courses and research. There are four major areas in ecology: organismal ecology, population-evolutionary ecology, community ecology, and systems ecology. In consultation with the student's steering committee, courses are chosen from these areas, as well as other disciplines. Specific research may encompass any of the four major areas of ecology and entail the study of the distribution and abundance of organisms, community structure including trophic relationships, diversity, succession, and ecosystem properties, such as patterns of energy transfer and biogeochemical cycling.

Entomology

ABRAHAMSON (Forest Insects, Pest Management), ALLEN (Forest Insects, Population Ecology), BREZNER (Physiology), CASTELLO (Virology, Insect Vectors), KURCZEWSKI (Morphology, Taxonomy, Behavior), MILLER (Pest Management), MITCHELL (Population Ecology), NAKATSUGAWA (Toxicology), NORTON (Soil Arthropods, Systematics, Insect Larval Taxonomy), RINGLER (Aquatic Entomology), SIMEONE (Forest and Wood-inhabiting Insects), TEALE (Insect Pheromones), TURNER (Physiology)

Adjunct Faculty: APPLETON (Toxicology), CAMPBELL (Forest Insects), HOWARD (Medical Entomology)

Graduate study opportunities prepare students in the basic aspects of insect life and the role of insects in relation to man and his environment. The wide range of effects stemming from insect activity, from the beneficial to the deleterious, allows for a variety of research subjects in which insects play a major role. Thesis topics may concern insects that affect forests, shade trees and wood products, those relating to the health and well-being of man and those playing key roles as parasites and predators of pest species. Current research areas include population dynamics of forest defoliators, pheromone communications among beetles and moths, speciation of insects as understood through behavioral and cytogenetic study, effects of larvicides and fish predators on stream benthic insects, natural control of insects in forest systems, and basic biochemistry of insect detoxification mechanisms.

Environmental Physiology

BREZNER (Insect Physiology), CASTELLO (Plant Virology), GRIFFIN (Fungus Physiology), MITCHELL (Environmental Energetics), NAKAS (Microbial Physiology), NAKATSUGAWA (Insect and Vertebrate Toxicology), SCHAEDLE (Plant Physiology), TURNER (Animal Physiology), WILCOX (Plant Physiology)

Environmental physiology provides students with advanced training in the nature and control of biological processes. Current interests include mechanisms of action of plant growth hormones; biochemical regulation of seed germination; plant and microbial enzymology; virology; toxicity and disposition of insecticides and environmental toxicants in vertebrates; production and action of plant phytoalexins and antibiotics; plant defenses against phytophagous invertebrates; thermal exchange in bird eggs; mycorrhizae; ion transport; mineral nutrition; cambial physiology and photosynthesis.

Fish and Wildlife Biology and Management

ALEXANDER (Vertebrates, Herpetology), BALDASSARRE (Waterfowl), BROCKE (Vertebrates), CHAMBERS (Vertebrates), MÜLLER-SCHWARZE (Vertebrate Behavior), PAYNE (Ornithology), PORTER (Vertebrate Ecology), RINGLER (Fisheries, Aquatic Ecology), SHIELDS (Vertebrate Behavior), STEWART (Fisheries, Aquatic Ecology), TURNER (Vertebrate Physiology), VANDRUFF (Vertebrates, Ornithology), WERNER (Limnology, Fisheries)

Adjunct Faculty: BRANDT (Fish Ecology), BROWN (Wildlife Ecology), CHEPKO-SADE (Primate Behavior, SCHACHTE (Aquaculture, Pathology)

Study in this area provides students with advanced preparation in biological concepts of fish and wildlife populations as they relate to proper management. Increasing concern for these wild animal resources has been matched by strong student interest in educational programs which prepare them for careers in the fish and wildlife professions. Graduate education is rapidly becoming a universal prerequisite to employment as a professional fisheries or wildlife biologist.

Areas of research include population habitat relationships, predator ecology, fish behavior, wildlife in Adirondack ecosystems, urban wildlife relationships, endangered species studies, feeding ecology of fishes, stream ecology, Great Lakes fisheries, ecology of larval fishes and homing behavior of fishes.

Forest Pathology and Mycology

ABRAHAMSON (Forest Pathology, Entomology), CASTELLO (Forest Pathology), GRIFFIN (Fungus Physiology), MANION (Forest Pathology), NAKAS (Microbiology), POWELL (Plant Pathology and Molecular Biology), ROGERS (Plant and Molecular Biology), VALENTINE (Genetics), WANG (Mycology), WILCOX (Mycorrhizae), WORRALL (Forest Pathology)

Forest pathology and mycology trains students to develop an expertise responsive to the increasing pressures on forest and shade tree systems for wood fiber, public services, and amenities. This

requires new sophisticated levels of disease understanding, disease control, a broad knowledge of fungi, bacteria and viruses, their environmental impacts and their roles in biodeterioration. Areas of interest include: environmental, fungal and viral tree diseases; mycorrhizae; wood decay and biodegradation processes; monitoring and impact assessment of disease in forest and urban tree systems; chemical and biological control of tree diseases; epidemiology of tree diseases and the genetics of resistance to tree diseases and to pathogen variability; physiology of fungus growth and development; taxonomy and biology of decay and imperfect fungi; and fungus ultrastructure.

Plant Science and Biotechnology

BURGESS (Ecology), CASTELLO (Virology), GRIFFIN (Mycology, Fungus Physiology), LEOPOLD (Dendrology, Community Ecology), LOWE (Mycology), MANION (Pathology), NAKAS (Microbiology), POWELL (Plant Pathology and Molecular Biology), RAYNAL (Ecology, Taxonomy), ROGERS (Plant and Molecular Biology), SCHAEDLE (Physiology), SILVERBORG (Pathology), TEPPER (Anatomy, Morphogenesis), VALENTINE (Genetics), WANG (Mycology), WILCOX (Physiology, Mycorrhizae), WORRALL (Pathology), ZABEL (Pathology)

Adjunct Faculty: GOULD (Environmental Microbiology), MANTE (Biotechnology)

Plants, as the base for ecological food chains, serve as the structural and functional foundation of natural and managed systems. The plant science and biotechnology area of study provides opportunity in a broad range of specialties fundamental to the understanding of plants and their interaction with other organisms and for specializing in plant biotechnology. Emphasis is on forests and related plant systems. Current research interests include: dynamics of plant communities as affected by man and the environment; mechanisms of plant succession; epidemiology of forest and urban tree diseases; decay, discoloration and biomodification of wood; taxonomy, physiology, growth and ultrastructure of fungi; heritability of wood properties and disease resistance of trees; biochemistry and physiology of plant growth regulators; photosynthesis; mineral nutrition; mycorrhizae; morphogenesis in shoot and root systems; and plant tissue culture.

Soil Ecology

DINDAL (Invertebrates), MITCHELL (Invertebrates, Energetics), NAKAS (Microbiology), NORTON (Invertebrates), WANG (Mycology)

Soil ecology includes the study of interrelationships of soil-inhabiting organisms (as individuals, populations and communities) with their biotic, chemical, and physical environments. This field is a frontier of science because of the myriad of undescribed species of soil-dwelling arthropods, nematodes and annelids, and the wealth of incompletely understood symbiotic relationships. Soil ecology deals with fundamental aspects of biodegradation and nutrient cycling, important for improvements in crop culture and enlightened waste disposal.

The soil ecology area of study is supported by courses in physical aspects of soils, plant and animal taxonomy and general ecology.

Chemical Ecology

MÜLLER-SCHWARZE (Vertebrate Pheromones), SILVERSTEIN (Pheromone Chemistry), SIMEONE (Insect Pheromones), TANENBAUM (Microbial Chemistry), TEALE (Insect Pheromones)

The area of study in chemical ecology is offered by collaboration between the Faculty of Environmental and Forest Biology and the Faculty of Chemistry. Interested students should apply to the Faculty of major interest, which will have prime responsibility for setting requirements. Faculty from both areas can aid in the development of a plan of study enabling a student to acquire sophisticated skills in either chemistry or biology and an ample understanding of the other to grapple with problems requiring an understanding of both.

As a relatively new interdisciplinary endeavor, workers in this field attempt to understand organismal interactions, both intra- and interspecific, mediated by chemical substances such as hormones, pheromones, kairomones and phytoalexins. These occur at all taxonomic levels: between uni- and multicellular organisms, microbes and plants, plants and plants, plants and animals, microbes and animals, and animals and animals. Study of such interactions has been accelerated in recent years through joint efforts of biologists and chemists in meaningful research accompanied by a growing body of literature.

The Faculty of Environmental Studies

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RALPH A. SANDERS, Chair (Economic Development, Urban and Regional Planning, Urban Ecosystems, Quantitative Modeling and Methods)

Faculty: DALL (Environmental Law and Policy), FELLEMAN (Land Use), HENNIGAN (Environmental Policy and Management, Water Resources and Water Quality Policy and Management), SMARDON (Landscape and Environmental Planning, Visual Resource Analysis, Environmental Assessment/ Administration, Wetland Assessment)

Participating Faculty: BLACK (Water and Related Land Resources), COUFAL (Silviculture, Environmental Ethics, Forest Education, Policy and Management), GRATZER (Forest Recreation, Forest Management), HALL (Systems Ecology), J. M. HASSETT (Environmental Modeling, Waste Management, Public Policy and Environmental Regulation, Energy Resources and Systems), J. P. HASSETT (Environmental Chemistry), HERRINGTON (Forest Management-Computers, Micrometeorology), HORN (Forest Management, Law), LEWIS (Community Land Use Planning, Planning Theory, System Dynamics, Modeling and Simulation), NAKATSUGAWA (Toxicology, Insect and Vertebrate Toxicology, Microbiology), J. PALMER (Landscape Perception, Design Evaluation, Social Impact Assessment, Environment and Behavior Research Methods), TOLL (Environmental Monitoring, Risk Assessment, Environmental Policy)

Adjunct Faculty: EFFLER (Water Quality Modeling), KARP (Environmental Land Use Law), O'LEARY (Public Administration and Law, Environmental Policy), SIEGEL (Groundwater Modeling)

The Faculty of Environmental Studies hosts two degree programs, the bachelor of science in environmental studies (ES) and the graduate program in environmental science (GPES), which awards both M.S. and Ph.D. degrees.

The GPES and the ES programs address environmental issues of high public concern and rely upon the scientific and professional expertise of the College faculty. These programs provide for the study of environmental systems and the interrelationships of human and natural systems. Both are guided by a concern for finding and promoting wise public policies for natural resource and environmental stewardship. Each program provides a set of core or foundation courses dealing with understanding and analyzing complex environmental systems in their human context, and a range of student choice in choosing interdisciplinary subjects for concentration. Faculty offering instruction and advisement for these programs are drawn from the academic units of the College, and work with students to shape their programs of study to blend student interests with program goals.

Bachelor of Science in Environmental Studies

The bachelor of science in environmental studies (ES) program is concerned with the interrelationships among the natural environment, natural resources, and human society, including society's institutions. The goal of the program is to educate students to be sensitive, articulate, and knowledgeable about complex environmental issues facing contemporary society. To achieve this, the ES program promotes (a) sound preparation in technical and scientific subjects and skills, (b) grounding in an environmental option, and (c) a synthetic or holistic viewpoint and understanding of environmental concerns.

The B.S. degree is granted at the end of four years and requires the successful completion of 121 credit hours of coursework. The program provides for a pyramidal sequence of study. At the lower division, students acquire a basic knowledge in the natural and social sciences, receive exposure to the humanities, and learn useful communications and analytic skills. Students then enter the ES program as juniors with 60 lower division credits. At the upper division, the student is provided a balanced understanding of natural and social processes as they relate to the environment, an additional set of useful skills and methods, and a progressive integration of this knowledge through an environmental option, leading to a synthesis of environmental studies education in the senior year.

The scope and complexity of coursework within the ES program demands both discipline and commitment from students seeking this degree. A clear sense of purpose and objectives are necessary to

pursue the curriculum beneficially. To meet each student's objectives fully, a close working relationship between faculty and the student is also necessary. A general orientation for upper division study is provided in the program's four study areas, one of which is chosen by the student during the admissions process, before undertaking upper division study. These study areas are: (a) information and technology, (b) land use planning, (c) biological science applications, and (d) policy and management. Within these general areas of study, students are provided flexibility to further pursue their environmental interests.

Students receiving the B.S. degree have pursued graduate study and careers in the fields of planning, landscape architecture, natural resource management, and other environmentally related areas such as business, education, and law.

Prerequisites for Entry into the Environmental Studies Program

The wide range of opportunities available to students who enter the ES program, requires that they prepare themselves with a broad range of lower division coursework. The accompanying table of lower division requirements summarizes preparation for entering the ES program. The various requirements provide a sound basis for successful engagement of the environmental studies curriculum at the upper division, for any of the four program study areas.

Prospective ES students are strongly advised to review ES program literature describing the four study areas, so that their study area selection is

Lower Division Coursework[1]

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area — *Credit Hours*

A. Natural Sciences 15-20
Coursework must include: General Biology[2] (6-8) (or General Botany and General Zoology), General Geology/Earth Science ((3-4), General Chemistry or General Physics[3] (6-8).

B. Social Sciences 18
Coursework must include: Economics (3), Government/Political Science (3), Sociology/Cultural Anthropology (3), History (United States) (3), additional coursework, including Psychology, Human Geography, or courses in above subjects (6).

C. Humanities 6
Courses in Literature, Philosophy, Foreign Language, Art, Music, Drama and related subjects.

D. Written Communications[4] 6

E. Mathematics and Computer Applications 6
Coursework must include: College-level Trigonometry, Pre-Calculus, or Calculus (3), Computer Applications (3).

F. Additional Coursework[5] 4-9

Total minimum lower division credits 60

[1]Prior to enrollment into the program, the student must have completed at least 54 of the 60 required lower division credit hours.

[2]At least two courses with labs are required.

[3]Two courses in general chemistry or general physics, or one course in each will satisfy this requirement.

[4]Courses aimed primarily at improving writing skills are intended; these generally do not include literature courses.

[5]Depending on student interests, an additional course in American government or in either general chemistry or general physics, whichever has not been taken to meet the natural sciences requirements, is recommended.

made on an informed basis. The role of the study area within each student's program is summarized in the accompanying table of upper division requirements, and each of the study areas provides a distinctive orientation to environmental study, as follows:

Information and technology is designed for students interested in learning about sources of environmental information, and about measurement and technologies applied to the solution of environmental problems. Work in this study area is supported primarily by the Faculty of Forest Engineering.

Land use planning is concerned with the orderly, efficient, equitable, and aesthetic development of land with special concern for the state of the natural environment and the development, interpretation, and administration of land use plans and regulations. This study area is supported mainly by the Faculty of Landscape Architecture.

Biological science applications is designed for students interested in carers at the interface of biology and socioeconomic issues. It will provide solid background in the biological sciences pertinent to our natural resources and ecosystems on one hand, and a grounding in the social sciences on the other. This study area is supported mostly by the Faculty of Environmental and Forest Biology, but in contrast to the traditional biology program, emphasizes the societal overview of biology-based issues.

Policy and management is concerned with the basic principles, values, and techniques of natural resources and environmental management, including an understanding of the public policies and programs that underscore these concerns. The need to integrate diverse social, institutional, political, legal, and biophysical considerations inherent in attaining environmental objectives is emphasized. This study area is supported mainly by the Faculty of Forestry.

Students seeking admission into the ES program should note particularly that identification of choice of study area is required as a condition of final acceptance into the program. This allows students to begin study area coursework in the first semester of the junior year.

Upper Division Courses

Credit Hours

A. ESF 332, Seminar for New Transfer Students 0

B. Foundations of Environmental Studies .21-22
Coursework is intended to provide a balanced exposure to the range of natural and human aspects of environmental study. The foundation includes 12-13 credit hours of natural science, including FOR 345 Soils, FOR 341 Hydrology and Water Quality, EFB 320 General Ecology, and one course from the following selection: EFB 303 Introduction to Environmental Microbiology, EFB 326 Diversity of Plants, EFB 336 Dendrology, ESF 352 Elements of Entomology, EFB 355 Invertebrate Zoology, EFB 480 Principles of Animal Behavior, EFB 483 Biology of Birds and Mammals, FCH 496 Organic Chemistry, or GOL 242 Environmental Geology. The foundation also includes 9 credit hours of social science coursework, including EST 496 (Section) Attitudes, Values, and Environment, EST 321 Government and Environment, and EST 496 (Section) Environmental Alternatives, or acceptable alternatives to these social science courses.

C. Skills and Methods 13
Coursework is intended to provide grounding in technical communications and technical methods. The technical communications requirements for 4 credit hours and includes CMN 410 Writing for Professionals, and LIB 300 Library Research. Technical Skills and Methods require 9 credit hours including 3 credits of statistics, 3 credits of other methods, including APM 360 Introduction to Computer Programming, CMN 531 Environmental Communications, EIN 510 Creative Problem Solving Seminar, FOR 450 Introduction to Environmental Impact Analysis, GEO 381 Principles of Cartographic Design, IST 255 Introduction to Information Technology, or PHI 251 Logic.

D. Areas of Study 12
Coursework selections for an option provide focus for the student's environmental studies program, and commence in the junior year of study. Study areas are: information and technology, land use planning, biological science applications, and policy and management. A 12 credit hour core of study is provided for each.

For information and technology, the core is: ERE 310 Environmental Measurements and Spatial Information, ERE 435 Environmental Technologies: Water and Wastewater Treatment, ERE 437 Decision Modeling for Environmental Management, and ERE 450 Introduction to Geographic Information Systems. For Land Use Planning, the core is: LSA 411 Natural Processes in Planning and Design, LSA 451 Comprehensive Land Planning, EIN 496 Land Use Development Process, and LPP 456 Land Development Law. Core courses for the biological science applications option include 6 credits of biological resource courses, from which will be selected 3 credits of plant resources and 3 credits of animal resources coursework. Additional coursework of 6 credit hours is selected to provide depth in some area of biology. For policy and management, the core is: FOR 307 Environmental Economics, FOR 360 Principles of Management, FOR 465 Natural Resources and Environmental Policy, and FOR 588 The Law of Natural Resource Administration.

E. Additional Courses.. 12
This coursework provides students with an opportunity for additional educational breadth and depth in environmental studies. In this category, students complete 6 credit hours of additional study area courses on topics that lie within the scope for the chosen study area. The use of additional courses varies by option. In biological science applications, students must complete one course in each of two other options. Information and technology and land use planning provide suggested elective concentrations for further study. Policy and management provides elective concentrations for further study but also identifies a specific elective concentration is recreation resource management, which requires FOR 372 Fundamentals of Outdoor Recreation and FOR 479 Outdoor Recreation Management, and two courses from the following: FOR 473 Planning and Development in Forest Recreation Areas, FOR 474 Commercial Recreation, FOR 475 Sociology and Psychology of Leisure Behavior, and FOR 478 Wilderness Management.

F. Senior Synthesis 3
Students are required to complete 3 credit hours of coursework during their senior year that synthesizes their environmental studies education. This is accomplished through appropriate course selection following the advice of the academic advisor, and may at times be in the form of a small group seminar or internship.

Total minimum upper division credits......61-62

A total of 121-122 credit hours is required to complete the environmental studies curriculum. Normally up to 60 credit hours taken prior to matriculation at the College of Environmental Science and Forestry will be accepted as advanced standing credits. A minimum of 51 upper division credit hours must be completed to be considered for graduation.

Graduate Program in Environmental Science

The graduate program in environmental science (GPES) offers M.S. and Ph.D. degrees. GPES was created in the early 1970s as a unique response to the emerging institutional and analytical challenges of developing environmental problems. The program, which draws upon faculty from across the College, emphasizes a multidisciplinary social and natural science approach to environmental understanding and stewardship. It maintains a strong academic orientation, facilitating student and faculty engagement of fundamental environmental challenges such as federalism, participatory democracy, the uses and limits of scientific prediction, risk, and sustainability.

The mission of GPES is to provide interdisciplinary education, research, and public service to foster effective environmental stewardship and to prepare students to comprehensively address environmental concerns and problems. The program provides for the following:

1. *Multidisciplinary approach:* recognition of the necessity to approach environmental problems with input from several disciplines and professions;

2. *Holistic perspective:* awareness of and deference to the interdependence of elements within broadly defined ecosystems, including physical, biological, social, and economic systems;

3. *Topical grounding:* competency to understand and apply the principles of a particular subject of environmental inquiry in sufficient depth to interact with other disciplines and professional fields;

4. *Realistic experience:* through internships, focused projects, theses and seminars which

provide for direct interaction of legal, economic, political, and social systems which underlie decision-making.

GPES's internal structure incorporates a common core which provides a broad policy-oriented foundation for the focused areas of study. Students applying to GPES must select which area of study they intend to pursue.

Requirements

The academic requirements of the graduate program in environmental science are designed to provide graduates with a sound preparation to meet the rapidly evolving challenges of the field as leading scholars and professionals. Programmatic requirements constitute a framework which includes: (1) a comprehensive core foundation emphasizing theory, issues, and methods; (2) extended knowledge within an area of study; and (3) a synthesis experience.

Entering students should be adequately prepared to engage graduate level work in the program. The following undergraduate courses are required pre- or co-requisites for all students: statistics, ecology, and micro-economics or environmental economics. Courses in political science are strongly recommended.

In addition, students should have an academic background and/or work experience related to the selected area of study. Wherever possible, deficiencies should be made up prior to matriculation.

Master of Science

The master's degree is designed as a two-year experience.

1. Core

   Required coursework: A total of 15 credit hours with the following distribution: 9 credit hours chosen from (i) institutions, government and the environment; (ii) environmental history, values and society; and (iii) environmental policy analysis and decision-making. In addition, 3 credit hours in quantitative methods; and 3 credit hours in advanced environmental policy are required as determined by the study area faculty.

2. Area of Study

   A minimum of 15 credit hours (excluding 898 and 899 courses) in the area of study, as determined by the major professor and area of study faculty.

3. Synthesis

   The student may choose between two alternatives:

   a. Thesis or project: a minimum of six credit hours of research resulting in a document that clearly demonstrates graduate level accomplishments of the student, followed by a defense examination; minimum total credits for degree is 36.

   b. Professional experience:

      i. a minimum of 12 additional credit hours of coursework including six credit hours in an internship with a public or private organization, followed by a comprehensive examination; minimum total credits is 42.

      ii. concurrent degree law students in this option complete a six credit hour internship followed by a comprehensive exam; minimum total credits is 36.

Doctor of Philosophy

The Ph.D. program provides a unique opportunity to develop environmental policy related research within a strong College community of environmental analysts, and to draw upon the expertise of scholars at Syracuse University. All applicants are expected to have completed a master's research thesis. A copy of the thesis abstract should accompany the application. In addition, entering students are required to complete the equivalent of the GPES masters' core either from prior graduate study or coursework taken within the first year of residency.

Areas of Study

Environmental Land Planning

Participating Faculty: FELLEMAN, GRATZER, LEWIS, PALMER, SANDERS

Land planning is a continuous process that guides decision-making related to the location and functional character of human activities. Planning involves the description and analysis of biophysical and socio-economic systems; the development and application of methods to generate and evaluate alternative future scenarios; and the synthesis of a variety of regulatory and economic implementation strategies. Sophisticated information systems

are used to monitor dynamic change and facilitate multiple parties including private sector firms, local, state, and federal agencies, and a spectrum of interest groups. These parties often have differing goals and values which need to be reconciled.

Planning is essentially concerned with the future. Its activities address short term transactional guidance such as permit systems, mid-range tactical decisions such as facility siting, and long range strategic analysis such as comprehensive plans and legislative enactment. Our ability to understand the future is based on knowledge gained from the critical study of history, and case studies of current practice.

Environmental Modeling and Risk Analysis

Participating Faculty: HALL, J. M. HASSETT, J. P. HASSETT, HERRINGTON, NAKATSUGAWA, TOLL

The environmental modeling and risk analysis study area focuses on problems in environmental and natural resource policy in which technical issues are of central importance. The program is designed for graduate students with a science or engineering background. Current research includes: spatial model construction, ecosystems modeling, development of model assessment and selection criteria, environmental risk assessment, use of technical information by regulatory agencies, land use forecasting for public policy decision-making, and water resources assessment and planning. The environmental modeling and risk assessment area of study provides a unique opportunity to study interdisciplinary problems. Specific coursework in environmental modeling and risk assessment is supplemented by traditional disciplinary coursework in engineering or the natural sciences and policy analysis.

Environmental Policy and Democratic Processes

Participating Faculty: DALL, FELLEMAN, HENNIGAN, PALMER, SANDERS, SMARDON, TOLL

Environmental policy studies are designed to achieve a systematic, interdisciplinary understanding of public decisions for environmental protection and resources management. Essential subjects include the institutional setting and processes in which environmental policy is established and operates, the social forces which support the system, and techniques for the evaluation of policy decisions and their outcomes.

Environmental policy refers to decisions intended to achieve environmental quality goals. Analysis of environmental policy generally includes the examination of alternative goals and alternative means for their achievement. Various techniques of policy science are employed in analysis. Environmental policy studies also includes the system actors, participants, institutions and processes which set the agenda and provide for the adoption, implementation, and evaluation of policies.

Water Resources Management

Participating Faculty: BLACK, BOYER, J. M. HASSETT, J. P HASSETT, HENNIGAN, MCCLIMANS, SMARDON

The water resources management area of study develops an understanding of technical, social and institutional aspects of water resources management. Individual students may emphasize scientific or social subject areas but all study in both areas. Scientific aspects include the basic physical, chemical, and biological interactions occurring in water resource systems. The social aspects are concerned with planning, regulation, law and institutions, and management of water resources. Water serves as a focus for graduate study in water and related land resources management, and water pollution and water quality control.

Recommended coursework includes: (1) physical sciences: civil engineering, geology, geomorphology, hydrology, meteorology, environmental engineering, soils, water chemistry, hydrogeology hydrogeochemistry, and geographic information systems; (2) biological sciences: ecology, entomology, fishery biology, forestry, microbiology, water quality, and limnology (3) social sciences: administration, economics, government, history, law, ethics, philosophy and policy.

The Faculty of Forest Engineering

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BROCK (Photogrammetric and Geodetic Engineering, Geo-spatial Information Systems), DUGGIN (Image Analysis, Remote Sensing, Atmospheric Modeling, Physics), HASSETT (Environmental Engineering, Water Resources), HOPKINS (Surveying, Geo-spatial Information Systems, Remote Sensing), LEE (Computers and Systems Engineering, Transportation and Equipment, Soil Mechanics), MCCLIMANS (Soils, Hydrology, Site Engineering), D. PALMER (Engineering Economics, Energy, Production and Harvesting Systems), TOLL (Environmental Monitoring, Risk Assessment, Environmental Policy), TULLY (Structures, Engineering Hydrology, Water Resources)

A large portion of our nation's resources exists on forested and rural lands. These include: the increasingly valued renewable resources of timber, biomass and wildlife; the sustaining resources of water, soil and nutrients; and the derivative resources of paper, wood, and fibrous products and recreation and amenity values. Forest engineering is a unique field of engineering which is concerned with the design of systems and facilities to improve the sustained high quality yield of resources and multiple use benefits of goods and services from forested and rural lands.

The undergraduate curriculum in forest engineering provides a broad base of study and specialized education in engineering with an emphasis on site development for improved resource use and conservation. Instruction focuses on: locating and quantifying resources; designing harvesting, conveyance and transportation systems and networks for water and timber; designing structures, facilities and pollution abatement systems; and engineering planning for the development of sites and regions for multiple use.

The special importance of continual measurement and evaluation of the broad scaled parameters which affect the resource base, provides unique opportunities for study to students aiming toward professional careers involving the conceptualization, design, and maintenance of geographically referenced resource information systems. This includes elements of surveying, photogrammetry, remote sensing, and resource information systems design.

Lower Division Courses

Students entering this program through the freshman admissions option should refer to page 55.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
General Biology	3
General Chemistry with Laboratory	8
Engineering Physics with Laboratory	8
Calculus through Differential Equations	15
English	6
Economics (Macro and Microeconomics)	6
Engineering Drawing (Graphics)	1
Computer Programming	3
Engineering Mechanics (Statics and Dynamics)	5
Electrical Science	3
Humanities or Social Science Electives	3
Total minimum lower division credits	61

Undergraduate Program

The primary objective of this degree program is to prepare qualified engineering graduates to operate with professional competence within the context of forest and natural resources development. The curriculum includes basic, forest, and engineering sciences. It utilizes elements of traditional engineering disciplines and develops its unique aspects from interweaving engineering design with an understanding of the natural environment and its renewable resource base including water, soil, timber, wildlife, and amenity values. Studies in the humanities and social and economic sciences are integrated throughout the curriculum to help achieve a broad and balanced perspective of professional practice in forest engineering.

Forest engineering students with an interest in graduate study can plan their undergraduate studies along an individualized track which will prepare them for entry into a master of science program in environmental and resource engineering at ESF. In this way, forest engineering students who qualify will be admitted to a quality graduate program with minimal inconvenience or interruption in their studies.

Upper Division Courses

Junior Year

			Credit Hours
First Semester	ESF 332	Seminar for New Transfer Students	0
	ERE 362	Mechanics of Materials	3
	ERE 371	Surveying for Engineers	3
	FOR 321	General Silviculture	3
	CIE 327	Principles of Fluid Mechanics	4
	EFB 335	Dendrology	2
	Elective		3
			18
Second Semester	FEG 340	Engineering Hydrology and Flow Controls	4
	FEG 350	Introduction to Remote Sensing	2
	FEG 363	Photogrammetry I	3
	MEE 285	Introduction to Computers in Design	3
	APM 395	Probability and Statistics for Engineers	3
	ERE 351	Basic Engineering Thermodynamics	2
			17

Senior Year

			Credit Hours
First Semester	FEG 410	Structures I	4
	FEG 420	Harvest Systems Analysis	1
	FEG 430	Engineering Decision Analysis	3
	CIE 337	Soil Mechanics and Foundations I	3
	FOR 477	Resource Policy and Management	3
	Elective		3
			17
Second Semester	FEG 454	Power Systems	2
	FEG 437	Transportation System	3
	ERE 440	Water Pollution Engineering	3
	FEG 489	Forest Engineering Planning and Design	3
	Elective in Engineering Design Sequence		3
	Elective		3
			17
	Total minimum upper division credits		69

A total of 130 credit hours is required to complete the B.S. degree in forest engineering.

In addition, qualified graduates in search of advanced degree education enjoy ready acceptance to engineering graduate schools throughout the country. Graduates of the forest engineering curriculum may enter a five-year program in either civil, or mechanical engineering at Syracuse University. A bachelor of science degree in engineering will be awarded by Syracuse University upon completion of the requirements of the fifth year.

To enter the forest engineering curriculum at the junior level, a transferring student must have acceptable college credit in the designated coursework areas or be able to have suitable coursework substitutions for courses listed in the junior and senior years.

The curriculum in forest engineering is accredited by the Engineering Accreditation Commission/Accreditation Board for Engineering and Technology (EAC/ABET).

Lower and Upper Division Elective Requirements for Those Entering Through the Freshman Residency Program

For those students entering the sciences and engineering track in the freshman residency program with the intention of pursuing the upper division program in forest engineering, the following guidelines should be considered when planning their program:

Humanities or social sciences: electives taken throughout the full four-year curricula must include at least nine credit hours in social sciences or humanities, at least three of which are recommended to be upper division. Humanities coursework deals with branches of knowledge concerned with man and his culture, while social sciences coursework concerns individual relationships in and to society. Traditional subjects in these areas are philosophy, religion, history, literature, fine arts, sociology, psychology, anthropology, economics, and modern languages beyond the introductory skills courses, while modern nontraditional subjects are exemplified by courses such as technology and human affairs, history of technology, and professional ethics and social responsibility. Subjects such as accounting, industrial management, finance, personnel administration, ROTC studies, and skills courses, such as public speaking and technical report writing, do not fulfill the humanities and social science content.

Students having advanced placement credits are encouraged to work closely with their advisor in order to best prepare for various upper division elective sequences in technology, science, design or management.

Engineering design: At least three credit hours are required in upper division engineering coursework as part of an advisor approved sequence which complements other forest engineering coursework and provides the equivalent of at least one credit hour of depth in the design and synthesis component of the program, such as:

Structures II
Soil Mechanics II
Air Pollution Engineering
Photogrammetry II
Synthesis of Mechanical Systems
Advanced Topics in Hydraulics

Graduate Opportunities

Through the program in environmental and resource engineering, the faculty participates in graduate education leading to the master of science and doctor of philosophy degrees.

Graduate studies and research are primarily concerned with environmental and resource related programs. Successful and individual programs of graduate study may be efficiently designed by students with bachelor of science degrees in engineering or in forestry, natural sciences, physics, or mathematics.

See page 57 for more information on graduate study in environmental and resource engineering.

Support for graduate study and research in these areas is both internal and external. The internal support includes modern laboratory and instrumentation facilities in the engineering faculties at both ESF and in the Engineering School at Syracuse University. Exceptional support exists for programs in environmental engineering measurements in the form of remote sensing and photogrammetric laboratories and the extensive forest properties owned by the College at which research may be conducted.

External support comes from several active sources, including industrial, commercial and governmental. Over the past two decades, close cooperation has developed special study and research opportunities with these sources.

The Faculty of Forestry

BOB G. BLACKMON, Chair
107 Marshall Hall
(315) 470-6536

BOB G. BLACKMON, Professor and Chair (Soils, Forestry Education)

Syracuse Campus

ABRAHAMSON (Entomology, Pathology, Pesticides), ANDERSON (Forest Management), BENNETT (Economic Theory, Economic Thought in Forestry), BLACK (Water and Related Land Resources), CANHAM (Forestry Economics, Regional Economics, Natural Resource Economics), COUFAL (Silviculture, Environmental Ethics, Forest Education), CRAUL (Forest and Urban Soils), CUNIA (Operations Research, Biometry), DAVIS (Forest Management, Timber Harvesting), DAWSON (Recreation Management, Commercial Recreation and Tourism), DREW (Tree Physiology, Forest Autecology), ESCHNER (Forest Influences, Forest Hydrology), GRATZER (Recreation, Resource Management), HERRINGTON (Forest Management Computers, Micrometeorology), HORN (Forest Management, Law), HOWARD (Silvics, Forest Management), KOTEN (Forest Management, Management Science and Planning), MAYNARD (Tree Improvement), MORRISON (Forest Recreation), NYLAND (Silviculture, Forestry Practice), PETRICEKS (Resource Economics, International Forestry Economics), RICHARDS (Silviculture, Urban Forestry), STEHMAN (Statistics), WHITE (Forest Soils, Silviculture)

Ranger School, Wanakena Campus

BRIDGEN (Silviculture), MILLER (Roads, Installations, Timber Harvesting), O'NEILL (Ecology, Forest Management, Forest Protection), SAVAGE (Mensuration, Silviculture), WESTBROOK (Surveying, Personnel Management, Soil)

Adjunct Faculty: CASTRO (Social Forestry, International Forestry), FINGER (Environmental Communication and Politics), GRIFFITH (Spatial Statistics), HEISLER (Meteorology), HORSLEY (Silvics), MARQUIS (Silviculture), NEUHAUSER (Environmental Science and Renewable Resources), ROWNTREE (Urban Forestry), SHANNON (Forest Policy, Forest Resources Sociology), SLOAN (Policy), STITELER (Statistics), TABER (Extension Programs), ZIPPERER (Urban Forestry)

The educational program in the Faculty of Forestry leading to the first professional degree (bachelor of science) in forestry, is accredited by the Society of American Foresters (SAF). SAF is a specialized accrediting body recognized by the Council on Postsecondary Accreditation and by the U.S. Department of Education as the accrediting body for forestry in the United States.

Mission

The Faculty of Forestry, one of the nation's major forestry programs, shares with companion forestry schools a search for truth and excellence through the scholarly endeavors of instruction, research, and public service. The Faculty of Forestry seeks to enlarge the body of knowledge in forestry and natural resources and to share that knowledge with society. The Faculty strives to provide quality educational opportunities which encourage students to think critically, synthesize knowledge, communicate effectively, and utilize technology responsibly. The Faculty of Forestry serves a worldwide clientele, and thus has a major responsibility for educating students to function effectively in their own and in other cultures.

Programs of the Faculty of Forestry are designed to assist society in the development, protection, and management of forest resources of the state, region, nation, and the world. The mission encompasses the forest's commodity and social values such as wood, water, recreation, wilderness, and aesthetic beauty. Implicit in the mission is the dynamic interrelationship between forests and the human population.

To carry out the mission of the Faculty of Forestry, several educational programs are offered: associate of applied science, bachelor of science, master of science, master of forestry, and doctor of philosophy. In addition, the Faculty contributes to the body of knowledge through an active research program, and extends information to appropriate clientele through public service activities and a program of continuing education.

Support Goals

1. To provide opportunity for education at the associate degree level in forest technology to prepare graduates for careers as forestry and natural resource technicians in private and public sectors, or as preparation for pursuit of baccalaureate education.
2. To provide opportunity for undergraduate, collegiate-level education in resources management that prepares graduates to assume positions in industry, public agencies and consulting firms, at the entry level but with sufficient breadth and depth of education to allow them to assume increasing responsibility to at least the middle management level.
3. To prepare undergraduates for pursuit of graduate education at any of the world's graduate programs in forestry, natural resources, environmental science, or related disciplines.
4. To provide opportunities for graduate study at the master's level through a master of forestry program which enables graduates to pursue careers in operations and management of forest resources at the middle management level and beyond.
5. To provide opportunities for graduate study at the master's level through the master of science degree leading to employment in forestry and natural resource management and/or preparation for further study at the doctoral level.
6. To provide opportunities for advanced graduate study through the Ph.D. program, providing graduates with the technical, scientific and professional base to become leaders in forestry and related natural resource professions through employment in research, higher education, and managerial positions.
7. To provide students in the environmental studies program (policy and management study area) with the educational background to understand the concepts and skills pertinent to dealing with environmental policies and management of environmental programs, and to support other interdisciplinary programs in the Faculty of Forestry and across the College.
8. To maintain and enhance world-class research programs that add to the body of knowledge and, through publication of research results, contribute to state, regional, national, and worldwide informational needs of the forestry community.
9. To maintain a program of continuing education that extends knowledge through workshops, seminars, symposia, and publications.
10. To contribute to the total educational program of the College by offering service instruction at both undergraduate and graduate levels.
11. To provide an atmosphere that fosters an appreciation for the liberal arts and humanities and an understanding of the relationship between these disciplines and the biophysical sciences.
12. To instill in students a sense of community based on common goals, values, and expectations, and to provide them with an environment that fosters both individual creativity and an appreciation for the cooperative spirit
13. To address through undergraduate and graduate instruction, research, and public service the complexities of the socioeconomic and political environment in which modern resource management is practiced.
14. To provide an atmosphere which fosters a positive learning and working environment for women and members of underrepresented groups, and to be proactive in recruiting them into the Faculty of Forestry.

Undergraduate Program in Resources Management (General Forestry)

Professional forestry consists of a blend of environmental, social, economic, and biophysical disciplines as they relate to natural resources, and the ESF setting is ideal for teaching the interaction of these subjects. Syracuse is located in the center of the country's second most populous state. Urbanization and development in certain parts of New York and the Northeast are increasingly creating important land-use issues and conflicts. At the opposite end of the land use spectrum, wilderness is also very much present in New York. Within an easy drive of the campus lies the six-million-acre Adirondack Park, the oldest and largest wilderness area east of the Rockies. The park is only a few hours from New York City and other heavily populated areas. In fact, New York State's forests are located within a day's drive of almost one-third of the U.S. population.

Recreation accounts for another key use of New York's forests. The many ways in which people enjoy the forests–whether as campers, hikers, skiers, vacationers on mountain lakes–have many

outlets within the state. From the Catskill Park north of New York City, to the Allegany State Park in the southwest corner of the state, to the Adirondack Park, this and other intense public uses of the forest give the Faculty of Forestry the opportunity to teach students the various alternatives for dealing with the many issues that develop as modern society continues to interface with the forest.

In addition, there are approximately 500,000 private forest land owners in the state, many of whom are deriving financial return from their forests. The forest products industry is a vigorous part of the New York economy, employing 88,000 people and accounting for a payroll of about $1.1 billion each year. The Faculty of Forestry recognizes the economic as well as social benefits of the forest, and strives to give its students an understanding of forest management that is both financially and environmentally sound. Many private forests are located near Syracuse and are used in teaching.

In essence, forestry is a broad academic endeavor. Education about the forest itself is founded in basic biophysical subjects such as biology, chemistry, physics, and mathematics. But as we approach the 21st century, forestry has become much more than the forest. Thus, in addition to the biophysical subjects and basic forestry, students are given an appropriate mix of social and environmental sciences, and communications. The result, we believe, is a graduate who can effectively deal with land and resource issues in a complex and ever-changing society. The Faculty of Forestry offers three undergraduate degree programs designed for students planning different career paths:

1. A professional forestry and natural resources management degree program, leading to a bachelor of science degree, offered at the Syracuse campus. A minor in management, using courses from Syracuse University's School of Management, is available within this program. It enables students to acquire specific additional managerial skills (see page 93 for details).

2. A dual option, leading to a bachelor of science degree, that meets the requirements of both the forestry and the environmental and forest biology degree programs. For details, see page 63.

3. A forest technology degree program, leading to the associate's degree, offered at the Ranger School campus. For details, see page 94. It is possible to transfer from this program to the bachelor degree programs, as explained on page 95.

The professional forestry and resource management program prepares students to manage forests and related resources for human benefit, while protecting and enhancing the environment. Through a carefully designed sequence of required courses and electives, students learn the principles and applications of forest ecology, techniques of forest measurement, and the principles of economic and managerial policy and administration. Electives allow students to concentrate their study in special areas of forestry or to broaden their education to fulfill personal or professional needs.

A seven-week summer field session at ESF's Wanakena Campus is the starting point of the program. This session emphasizes field skills and techniques, and introduces basic ecological and managerial concepts. *The summer session is required prior to registration for the junior year.*

The summer field session is followed by a highly integrated semester which includes an introduction to the physical environment (soils, and forest influences, which covers meteorology and hydrology), study of physical and biological influences on tree growth and development (silvics), and the manipulation of the ecosystem which can be made to take advantage of these responses (silviculture).

Electives comprise about one-fourth of the curriculum and allow students to shape their programs to meet their individual needs and interests. For example, one student might distribute electives among all areas of forestry's multiple uses, while another might concentrate them in areas such as watersheds, forest wildlife, recreation, entomology, pathology, soils, international forestry, or urban forestry. Electives may be taken at ESF and Syracuse University. SU electives include such areas as anthropology, geography, business management, and communications. Careful use of electives allows the student to tailor his or her educational experience to a social emphasis such as outdoor recreation or urban forestry, to an economic/financial/management emphasis through a minor in Syracuse University's School of Management, or to a strong biological and environmental science emphasis.

Elective courses are selected with the assistance of a faculty advisor, and should be planned early in the student's course of study. The student may elect to pursue a variety of independent or group study activities. These may be conducted in whole or in part at any one of the College's several campuses, off campus at another institution, or in cooperation with some resource management agency or firm. Proposals for off-campus study are subject to faculty review and approval and are carried

Lower Division Courses

Students entering this program through the freshman admissions option should refer to page 56.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
Biology (Botany and Zoology preferred)	8
General Chemistry with Laboratory	8
Physics I with Laboratory	4
Calculus I	3
Economics (Microeconomics required)	3
Political Science (U.S. Institutions)	3
Introductory Sociology or Introductory Psychology	3
Computer Applications	3
English[1]	6
Electives[2]	21
Total minimum lower division credits	62

out with faculty guidance to ensure adherence to academic standards.

A total of 135 credit hours is required to complete the B.S. program. Students contemplating entering it should have completed at least 62 semester credit hours or have earned an associate degree; further, a minimum of 56 of these credit hours must be distributed among specific course areas as outlined above. Students who have completed more than 64 lower-division credits may transfer up to 12 additional hours of junior-senior level courses and should seek advice on upper division credits at the time of matriculation. The professional forester must understand both the biological and social influences that affect forest resources. Prospective students should thus choose lower-division electives to broaden and enhance their communication skills and their understanding of social and political sciences and humanities.

Minor in Management

The resources management program, as described above, contains a core of knowledge of both resources and management sciences sufficient for the practice of forestry and related resources management. Students use electives to shape programs that meet their career objectives.

Using some of these electives, the minor in management provides a formal, focused opportunity to expand and broaden managerial skills, and is recognized via appropriate notation on the student's official transcript.

Using a part of the 26 credit hours of upper-division electives, the minor in management requires completion of five courses from the Syracuse University School of Management. Three of these courses are required, covering the legal system, money and banking, and marketing and society. The other two courses are selected from among lists of recommended and acceptable courses, with topics ranging from organizational behavior to labor relations, from corporate finance and operations management to real estate. Along with microeconomics and statistics, both part of the resources management degree program, students wishing to pursue a minor in management must take accounting as prerequisite to the minor, and are advised to take it as one of the lower-division electives.

Students must declare their intent to undertake the minor in management early in the fall semester of the junior year, using an application approved by the student's advisor and the Faculty of Forestry Undergraduate Education Coordinator. A G.P.A. of 2.500 in lower division coursework is required for admission.

Upper Division Courses

Summer Program in Field Forestry[3]

			Credit Hours
	FOR 301	Field Dendrology	1.0
	FOR 302	Forest Surveying and Cartography	2.5
	FOR 303	Introduction to Forest Measurements	3.5
	FOR 304	Introduction to Forestry	1.0
			8.0

Junior Year

			Credit Hours
Fall Semester	ESF 332	Seminar for New Transfer Students	0
	FOR 305	Forestry Concepts and Applications	1
	FOR 322	Forest Resource Measurements	2
	FOR 331	Forest Influences	3
	FOR 332	Silvics	3
	FOR 333	Silvics Laboratory/Practicum	1
	FOR 334	Silviculture	4
	FOR 345	Soils	3
	ESF 332	Seminar: Orientation	0
			17
Spring Semester	FOR 360	Principles of Management	3
	FOR 363	Management Models	3
	APM 391	Introduction to Probability and Statistics	3
	Electives[2]		6
			15

Senior Year

			Credit Hours
Fall Semester	FOR 400	Forest and Resource Economics	3
	FOR 470	Management of the Forest Enterprise	3
	APM 492	Forest Biometrics	3
	Electives[2]		6
			15
Spring Semester	FOR 465	Natural Resource and Environmental Policy	3
	Electives[2]		15
			18
	Total minimum upper division credits		73

A total of 135 credit hours is required to complete the B.S. degree in resources management—general forestry.

[1]Standard freshman English sequences are acceptable, but where possible the student is strongly urged to take technical report writing.

[2]Electives taken throughout the full four-year curriculum must include at least 9 credit hours of social sciences, such as anthropology, economics, geography, history, political science, sociology, and psychology; 9 credit hours of humanities, such as art, music, language, philosophy, and literature; 9 credit hours dealing specifically with at least two major resources (forage, minerals, recreation/amenities, water, wildlife, or wood); and another 3 credit hours in the area of forest protection (entomology, pathology, or fire). Of the total electives in the four-year curriculum, at least six must be taken in two or more of the Faculties at ESF other than Forestry.

[3]Summer program in field forestry consisting of seven weeks, eight credit hours, is required of all students (except forest technology graduates of the Ranger School). Other two-year programs will be evaluated on a case-by-case basis.)

Curriculum for Combined Forest Technology and Resource Management Programs*

Freshman Year	*Credit Hours*
(Completed at a college of the student's choice)	
Biology (Botany and Zoology preferred), with Laboratory	8
English (A technical report writing course is highly recommended.)	6
Calculus I	3
Microeconomics	3
General Chemistry, with Laboratory	4
Physics I, with Laboratory	4
Political Science (U.S. Institutions), or Introductory Sociology, or Psychology, or Computer Application	3
Minimum total credits, freshman year	31

Sophomore Year (Wanakena Campus)	*Credit Hours*
FTC 200 Dendrology I	2
FTC 202, 203 Plane Surveying I and II	5
FTC 204, 205 Forest Mensuration and Statistics I and II	5.5
FTC 206 Forest Ecology	3
FTC 207 Aerial Photogrammetry	3
FTC 208 Allied Technologies	3
FTC 209 Forest Roads	2
FTC 211 Silviculture	2.5
FTC 213, 227 Forest Protection I and II	4
FTC 214 Personnel Management	1.5
FTC 215 Timber Harvesting	2
FTC 217 Forest Management	3.5
FTC 218 Forest Recreation	1.5
FTC 219 Elements of Wildlife Ecology	1.5
FTC 221 Soil and Water Measurements	1.5
FTC 223 Graphics	1
FTC 228 Structure and Growth of Trees	1.5
FTC 229 Silviculture II OR FTC 230 Plane Surveying III	2
Total credits, sophomore year	46

Summer between Ranger School graduation and start of Junior Year

General Chemistry II, with Laboratory	4
Two courses fulfilling requirements for either political science (U.S. Institutions)/introductory sociology/introductory psychology/computer applications; or electives (See footnotes on page 93.)	6
Total credits, summer program	10

Junior Year	Credit Hours
FOR 305 Forestry Concepts and Applications	1
FOR 322 Forest Resource Measurements	2
FOR 331 Forest Influences	3
FOR 332 Silvics	2
FOR 333 Silvics Laboratory/Practicum	1
FOR 334 Silviculture	4
FOR 345 Soils	3
FOR 360 Principles of Management	3
APM 391 Introduction to Probability and Statistics	3
FOR 363 Management Models	3
Electives**	6
Total credits, junior year	31

Senior Year	Credit Hours
APM 492 Forest Biometrics	3
FOR 400 Forest and Resource Economics	3
FOR 465/665 Natural Resource and Environmental Policy	3
Electives**	20 - 23
Total credits, senior year	29 - 32

*This model is meant for those students who have the initial intent of attending the forest technology program (Ranger School) and the resources management—general forestry program (Syracuse campus).

**Electives will be used to complete social science, humanities, and professional coursework as indicated in the resources management curriculum.

Transfer from the Ranger School

Given the nature of the Forest Technology Program at Wanakena, students entering from the Ranger School are not required to attend the summer session in field forestry, the 8-credit-hour field experience other incoming juniors must attend. Instead, Ranger School transfer students are encouraged to use the summer prior to the junior year to complete the lower division requirements as outlined on page 94. The time spent on completing the bachelor's degree is thus two years for all students, but the configuration of courses differs somewhat between community college and Ranger School graduates.

There are several advantages to combining a Ranger School education with a baccalaureate program at ESF's Syracuse Campus. At the end of two years, Ranger School graduates have had a chance to explore some of the varied facets of forestry, an experience which can prove helpful when choosing electives. In addition, Ranger School graduates have earned an A.A.S. degree in forestry, and those who choose to work for a time before beginning the baccalaureate will have marketable skills. Most importantly, Ranger School graduates who go on to pursue the bachelor's degree have a solid field-oriented technical education as well as a managerial orientation and the deeper ecological and social understanding provided by the professional curriculum.

Graduate Education

The Faculty of Forestry offers two graduate programs: forest resources management, leading to the master of science (M.S.) and doctor of philosophy (Ph.D.), and forest management and operations, leading to the master of forestry (M.F.) degree. The Faculty of Forestry will also award up to eight credit hours for suitable Peace Corps service. Further details are available from the Graduate Studies/Research Coordinator.

Joint study with other SUNY ESF faculties and with Syracuse University is also possible. In a number of areas, particularly environmental and forest biology, programs of study can be established which formally include members of other Faculties of the College. Programs which provide the student with two masters' degrees, one from SUNY ESF and another from Syracuse University, are available with the following SU schools:

- School of Management
- Maxwell School of Citizenship and Public Affairs
- Newhouse School of Communications
- School of Education

The concurrent degree programs usually add an additional year of study to a normal master's program of study. To be eligible, a student must have been matriculated full-time at the College for at least one semester, must have a grade point average of at least 3.500, and must be formally accepted into the concurrent degree program.

Forest Resources Management (M.S., Ph.D.)

Graduate study programs in forest resources management are created to suit the needs of each individual student and are designed to prepare students for careers in resource administration, management, scientific research, professional education, and a variety of other specialized positions related to forest resources management. Students with nonforestry bachelor's or master's degrees and a strong interest in forest resources management are also encouraged to apply.

All candidates for the M.S. and Ph.D. must take two semesters of seminar (FOR 797) for each advanced degree they pursue. Candidates for the Ph.D. must also present a graduate seminar on their respective thesis topic. Additional graduate requirements are set by the College of Environmental Science and Forestry and discussed on pages 33-40.

Each graduate student selects (or is assigned) a faculty major professor who acts as the director of the student's study plan. The student and advisor are assisted in planning the program, and in determining successful completion of the program, by at least two other faculty members, who serve as the student's steering committee.

All three of the College's master of science program alternatives (thesis, professional experience, or coursework) are available to master's degree students in the forest resources management program. Students select the appropriate alternative in consultation with their committee. The master's degree usually takes two years of study.

Doctoral study is normally built upon a master's degree, but in some instances it can be undertaken directly after a baccalaureate degree. Doctoral programs usually involve 30 credit hours of formal coursework beyond that required for the master's degree. Written and oral candidacy examinations, intended to test the student's mastery of subject matter essential to the thesis topic, are required, as is an oral defense of the thesis.

Areas of Study

Thirteen areas of study in the forest resources management program are described below, highlighting examples of current faculty and student interest and activity. These examples do not indicate the full range of faculty interest. Similarly, these examples are meant only as highlights; many students have programs encompassing two or more areas of study.

Policy and Administration

Participating Faculty: BLACK, CANHAM, DAWSON, HORN, KOTEN

- Policy issues and analysis
- Administrative organization and management
- Program implementation

Graduate study in the area of policy and administration is designed to prepare students for positions at the planning, budgeting, programming, and operating levels of public agencies and businesses. The expanded regulatory role of federal and state government over resource use and land management has brought substantially increased need for thorough understanding of policy matters, legal

requirements, and governmental and political interactions with resource owners and users.

Programs of study include advanced courses, seminars, and special problems structured around these needs and the complex interrelationships of society and resources. Students are encouraged to round out their academic programs through courses offered by other units of the College and at Syracuse University. Interested students with undergraduate preparation in such areas as forestry, liberal arts, and engineering can be served through the creation of a study program that complements work already taken. The broad array of courses and the diverse points of view available allow the student to build a program to meet specific career objectives.

Forestry Economics

Participating Faculty: BENNETT, CANHAM, PETRICEKS *(Emeritus)*

- Timber and wood-using industry economics
- Regional economic impacts
- Economics of nonmarket goods

Graduate study in forestry economics prepares students for employment as forest economists or resource analysts with federal and state agencies and with private industry. Graduates with the Ph.D. usually pursue careers in teaching or research. The goals of study in this area are depth of understanding and familiarity with economic tools contributing to making competent decisions in resource economics, management, and policy. Students with undergraduate degrees in forestry or forest products can undertake graduate study in forestry economics. By adding courses in forestry, graduates with liberal arts, engineering, or business degrees can also enter the program.

The core of the student's program consists of courses in forestry and resource economics. In addition, the student must be aware of the social and biological environment in which forestry economics is applied. Thus, the core program is supplemented by courses in general economics, statistics and operations research, resource policy, business administration, and related managerial and biological fields. The program draws on course offerings and facilities of the College and of Syracuse University. Individual programs are tailored to fit the student's particular interest. Some examples are the economics of timber management, land use economics, economics of natural environments, economic development, and forestry.

Forest Management

Participating Faculty: COUFAL, DAVIS, GRATZER, HERRINGTON, HORN, KOTEN, NYLAND

- Resource information systems
- Resource planning and scheduling
- Forest operations
- Timber and multiple-use management

Graduate study in forest management requires a broad knowledge of the natural and societal environments as the basis for understanding how these environments affect (or are affected by) the development and use of forests and associated wild lands. Forest management focuses on the planning and implementation processes necessary to achieve integrated use of forests and associated natural resources. The educational objective is to develop expertise sufficient for capable, professional resource management under a variety of natural and societal environments.

Study programs are flexible, and students may pursue special interests in a single product, several products or services, tools and processes of planning for integrated forest use, or in developing managerial skills. The program's emphasis, however, lies in applying the skills and knowledge to the management of forest lands. Where appropriate, students may take courses at Syracuse University's School of Management and Maxwell School of Citizenship and Public Affairs to complement the College's offerings. Recent graduates have found employment with private and public organizations that own, manage, use, or relate in more indirect ways to forest resources. Students with the doctorate have engaged in research and teaching.

Recreation and Tourism

Participating Faculty: DAWSON, GRATZER, MORRISON

- Commercial recreation and tourism
- Recreation resource planning
- Wilderness and river recreation

Graduate study in this area equips students with a broad understanding of the nature and purpose of outdoor recreation and how it relates to natural resources. The program emphasizes the role of and interrelationships between the public and private sectors in providing recreation and tourism facilities, services, and programs. Individual programs combine study in resources management with rel-

evant studies in the social and political sciences and the development of analytic capabilities needed to implement management plans and programs. Other faculties of the College and within Syracuse University, treating such areas as planning, design, and education, provide a wide range of supporting courses and facilities.

Watershed Management/Hydrology

Participating Faculty: BLACK, ESCHNER *(Emeritus)*, HERRINGTON

- Hydrology
- Snow hydrology
- Soil and water conservation
- Meteorology/micrometeorology
- Water resources policy

Graduate study of watershed management/hydrology, as related to forest influences, includes energy exchange between forest and atmosphere; moderation of urban environments by vegetation; soil and slope stability; and watershed hydrology, including snow. Forest influences include all of the effects resulting from the presence of forest trees and associated vegetation on climate, the hydrologic cycle, erosion, floods, and soil productivity. Health considerations and human comfort, often included in older definitions of forest influences, are assuming even greater importance, given our growing concern for the environment.

Graduates in this area of study fill a variety of positions in research, teaching, and public and private management as watershed management specialists, hydrologists, environmental officers, meteorologists, and ecologists.

Silviculture

Participating Faculty: ABRAHAMSON, COUFAL, HOWARD, NYLAND, RICHARDS, WHITE

- Hardwood silviculture
- Conifer plantations
- Biomass production
- Greenspace silviculture

Graduate study in silviculture stresses the nature of cultural treatments, the theories underlying them, and the biological, physical, and social constraints to their implementation. Silviculturists study stand treatments for their value in producing goods and services and maintaining or enhancing productivity for the future.

Students in silviculture progress, through formal coursework and research, toward an understanding of how cultural treatments affect the balanced, sustained supply of wood, water, wildlife, recreation opportunities, and amenity values. One major area of emphasis relates to treatment of tree stands for their continued production of wood products and other commodities. Another centers on stand treatment for several values simultaneously, where the harmonious integration of uses is of concern. A third focuses on evaluation and manipulation of vegetation systems, primarily for their on-site values, such as recreation areas, highway and utility rights-of-way, and urban greenspace.

Silvics

Participating Faculty: DREW, HOWARD

- Tree physiology
- Forest ecology
- Stand dynamics

Graduate study in silvics examines the scientific basis for the cultural treatment of forest vegetation by studying and defining interrelationships within forest ecosystems and cataloging intraspecific characteristics of tree species. In a sense, silvics is the ecology of managed forest ecosystems, though unmanaged and natural forests are often studied intensively to provide the benchmark conditions from which the silviculturist begins.

The specialist in silvics must work closely with colleagues in the basic disciplines, including soil physics and chemistry, micrometeorology and climatology, genetics and tree breeding, plant ecology and physiology, wildlife biology, entomology, and pathology.

Forest Soil Science

Participating Faculty: CRAUL, WHITE

- Acidic disposition
- Soil physical properties
- Morphology and classification
- Soil chemistry/fertility

Graduate study in forest soil science may be directed toward soil science as it relates to goods and services produced, or to the impact of management practices on environmental quality. Study may include evaluation of ecosystems to quantify nutrient element balances and cycling, amelioration of soils for maintaining increasing ecosystem

productivity, and the impact of various land-use practices on soil properties. Other areas may include use of soils information in geographic information systems, ecological land classifications, and the development of expert systems that provide soil use interpretations from remotely sensed data.

Modern, well-equipped laboratories are available for plant, soil, and water chemical analyses; soil physical characterization such as water relations, compaction, aeration, and temperature regimes; and other soil property investigations. The extensive College properties permit forest soil research to be conducted under a wide variety of environments and ecological conditions.

Tree Improvement

Participating Faculty: MAYNARD

- Clonal propagation/tissue culture
- Genetic selection and testing
- Genetic engineering

Graduate study in tree improvement involves developing populations of trees that are well adapted, rapid growing, and free of disease. Although primarily used for enhancing the commodity uses of the forest, the same techniques can also be used to enhance the aesthetic and recreational values of trees. The program involves formal coursework in plant biochemistry and physiology, statistical genetics, and plant breeding. Tree improvement programs are also used to increase the aesthetic or recreational value of forest trees through selection for desirable traits.

Students have the use of a modern, well-equipped tissue culture laboratory and two greenhouses. They can collect materials and perform field trips on several College properties with extensive space devoted to tree improvement. Collaboration with researchers in the Faculty of Environmental and Forest Biology further enhances the opportunities for state-of-the-art research in molecular biology.

Graduates hold positions in seed orchard management, tree improvement, and forest genetics with private, state, and federal organizations.

International Forestry

Participating Faculty: DREW, GRATZER, PETRICEKS *(Emeritus)*

- All phases of forest resources management

Graduate study in international forestry is designed for individuals who want to pursue internationally oriented careers in forestry and related fields. Instruction is aimed at supplementing and enriching the student's technical forestry knowledge and providing the broad background necessary for service in a variety of professional circumstances: forestry advisor, teacher, or research specialist with national and international agencies, private business and industrial firms, philanthropic foundations, and voluntary service organizations whose activities include the development and use of forest resources in other nations.

At the master's level, students have the opportunity to gain competence in research methods, foreign languages, cultural anthropology, world geography, and international affairs, plus a solid understanding of the world forestry situation. At the doctoral level, the focus is on a specialized discipline area, such as forestry economics, forest policy and administration, forest management, or silviculture.

Syracuse University offers a wide variety of courses supporting the nonforestry elements of this area of study. Qualified candidates may undertake training and research in tropical forestry and related fields.

Urban Forestry

Participating Faculty: CRAUL, HERRINGTON, RICHARDS

- Urban soils
- Urban climate
- Urban forest management/planning
- Urban tree management

Graduate study in urban forestry allows the student to pursue a variety of objectives. Professional urban forestry skills may be enhanced through advanced coursework and applied research; students may also pursue more specialized study in soils, greenspace ecology, atmospheric science, forest science, tree improvement, forest resource inventory and evaluation, resource economics, and planning.

There is strong interaction with other urban-related areas of the College, including remote sensing, botany, pathology, entomology, wildlife ecology, and landscape architecture. Academic departments in Syracuse University's Maxwell School of Citizenship and Public Affairs such as geography, economics, political science, and sociology cooperate with teaching and research programs, as does the U.S. Forest Service Northeastern Forest Experiment Station, Urban Forest Research Project located on the ESF campus.

Quantitative Methods

Participating Faculty: CANHAM, CUNIA, DAVIS, HERRINGTON, HORN, KOTEN, STEHMAN

- Statistics
- Forest inventory/mensuration
- Computer applications/modeling
- Operations research/systems analysis

Graduate study of quantitative methods is designed to develop skills in the application of mathematical, statistical, and computer-based problem analysis and solution. Study in this area is designed primarily for two types of students: those with undergraduate degrees in areas such as the biological sciences, forestry, wildlife, or agriculture, who wish to strengthen their quantitative skills, and those with degrees in mathematics, statistics, or computer science, who wish to focus on resources management.

Students may concentrate in statistics, operations research, biometry, forest mensuration, econometrics, and computer applications development. Syracuse University's computer facilities, for example the Center for Advanced Technology in Computer Applications and Software Engineering (CASE Center), and the University's wide range of courses in mathematics, statistics, and quantitative methods, provide strong support for activities in this area.

Resources Information Management

Participating Faculty: CANHAM, CRAUL, DAVIS, HERRINGTON, KOTEN

- Information management systems
- Systems analysis
- Geographic information systems application

Information is a vital part of any organization, and as the "information age" develops, management of information is becoming increasingly important to the success of any enterprise. Much of the information foresters and other natural resource managers work with is geographic in nature and is amenable to analysis by spatial techniques. Thus, the focus of Resources Information Management is the use of geographic information systems (GIS) to manage information and provide the needed spatial analysis and modeling. However, nongeographic information is also important, and there is thus a need for traditional management information systems (MIS) technology as well.

As with quantitative methods and urban forestry, resources information management cuts across nearly all of the Faculty of Forestry's areas of study. The strongest interactions are with faculty and students in forest management, forestry economics, policy and administration, watershed management/hydrology, and forest soil science. There are strong ties with the Faculty of Environmental Studies, the Faculty of Forest Engineering, working with remote sensing and photo interpretation, and the faculty in Syracuse University's Advanced Graphics Laboratory, Department of Geography, and the School of Information Studies.

At the master's level, students' programs tend to focus on the application of existing analysis techniques to resource management problems while at the doctoral level, the focus is on the development of analysis and modeling techniques. M.S. students apply resources information management techniques to problems in their respective areas of interest, while Ph.D. candidates focus their energies on the mathematical, information science, spatial modeling, and computer science aspects of finding new ways to solve problems.

Forest Management and Operations (M.F.)

The Faculty of Forestry offers a professional graduate program in forest management and operations leading to the master of forestry degree.

This graduate program is designed for students with an undergraduate forestry education and a primary interest in continuing their professional development through advanced study of the planning, management, and operations necessary for the appropriate use of forest resources. Thirty-seven credit hours of coursework are required in this structured, intensive 11-month program. No thesis is required, but students take a written comprehensive examination in the spring.

Courses in the M.F. program build on and extend the student's basic undergraduate forestry education and provide opportunities to relate theory to actual forestry situations. Emphasis is on methods and skills in modern business management, policy processes, forestry economics, and information systems. Developing managerial skills is a key objective. These skills are then applied to managing forestlands, operating associated enterprises, or using forest resources.

The forest management and operations program consists of lecture courses, seminars, field experiences, and the written examination.

The following courses are representative of the program content:

Field Applications in Forest Management and

Operations
Finance (Private Industry) or Public Budgeting (Public Management)
Forest Resource Economics
Advanced Silviculture
Operations Management (Private Industry) or Public Administration (Public Management)
Information Systems for Forest Management
Seminars
Pest Management for Forestry
Forest Policy
Organization and Human Behavior
Advanced Forest Management
Field Applications in Integrated Forest Management
Elective

Ranger School—Forest Technology Program

In 1912, some 1,800 acres of land in the Adirondack Mountains were donated to the College as a site for the development of a Ranger School. Since that time, the forest technology program has trained over 3,000 graduates, most of whom are now working in a variety of forest activities, and it has earned the Ranger School a national reputation for excellence. The program is administered by and is an integral part of the Faculty of Forestry. This unique model of a single professional Faculty offering all levels of work from technical through post-doctoral emphasizes the teamwork approach to forest resource science and management espoused by the faculty.

The two-year curriculum trains students in forest technology. The degree of associate in applied science (A.A.S.) in forest technology is awarded. The objectives of the curriculum are to provide students with a knowledge of the field practice of forestry as related to forestry managerial needs; the ability to work and communicate effectively with professional and paraprofessional forestry personnel; and an understanding of the sciences and practices of forestry with some emphasis on ecological applications.

Graduates are generally classified as forest technicians, forestry aides (or surveying technicians) in initial employment positions. Forestry agencies and wood-using industries employ forest technicians as an important part of their forest management teams, usually as the "people on the ground" who plan and execute the field practice of forestry, normally under the supervision of a professional forester. (Surveying firms employ 25 percent or more of the graduates each year to work with crews on road, boundary, right-of-way, mapping, construction, and exploration applications of plane surveying.)

The curriculum is designed to allow graduates immediate job entry at the technical level. Students interested in a baccalaureate degree in forestry and resource management should investigate the Faculty of Forestry's bachelor's degree curriculum described on page 92. It should be understood that transfer into the Faculty of Forestry's professional forestry curriculum is possible upon completion of the A.A.S. degree at Wanakena. Transfer into other baccalaureate programs at ESF may be possible, but students should consult as soon as possible with the Undergraduate Admissions Office.

Student who feel transfer to baccalaureate program is a possibility after graduation from the forest technology program, should pay close attention to the footnotes under "Freshman Year" on page 102.

The freshman year forest technology curriculum consists of general studies courses which may be taken at any accredited four-year college, or agricultural and technical institute except SUNY Farmingdale (although transfer credits from this school is acceptable).

The second year of the curriculum is offered at the Faculty of Forestry's forest technology program on the Wanakena Campus. Presented in a varied forest environment, the curriculum's emphasis is on fundamental forestry knowledge and applied field training as well as the relationships between forest technology and managerial needs. About 50 percent of the studies are devoted to field exercises, most of which are held on the School's forest. This managed forest, containing both hardwood and coniferous species, covers an area some 3 miles long with widths varying up to 2 miles. On two sides, the forest is bounded by state forest preserve lands. The forest is also adjacent to several square miles of virgin timber within the Adirondack Forest Preserve. This excellent forest backdrop for the technology program provides a diverse laboratory for instructional purposes.

Since the program is situated within a forest environment, some applicants may mistakenly believe that the forest technology program is one of forest lore and wilderness survival. It is, therefore, strongly emphasized that the forest technology curriculum demands high quality academic achievement. Students cannot complete the program without concentrated and consistent study. Classes are scheduled from 8 a.m. to 5 p.m., Monday through Friday, with classroom and laboratory or field time equally divided. The intensity of the program normally requires a minimum of 70

FOREST TECHNOLOGY CURRICULUM
(Associate in Applied Science Degree)

Freshman Year (Completed at a college of the student's choice)	*Credit Hours*
General Biology[1]	6-8
English (a technical report writing course is highly recommended)	6
Math[2]	4-6
Economics	3
Electives[3]	7
	30

[1]Courses selected may be in general biology, but at least one course in introductory botany is preferred.

[2]Competency in plane trigonometry and college algebra is required. If demonstrated, credits become electives. For those students who feel transfer to a baccalaureate program is a possibility, they would be well advised to take calculus.

[3]For those students who feel transfer to a baccalaureate program is a possibility, general chemistry and physics should be taken as electives. Otherwise, courses in sociology, psychology, political science, geology, soils, accounting, business, computer science, etc. are desirable electives.

Senior Year
(Ranger School)

			Credit Hours
First Semester	FTC 200	Dendrology.	2
	FTC 202	Plane Surveying I & II	5
	FTC 204	Forest Mensuration and Statistics	3.5
	FTC 206	Forest Ecology	3
	FTC 207	Aerial Photogrammetry	2
	FTC 208	Allied Technologies	2
	FTC 210	Computer Applications	1
	FTC 213	Forest Entomology	1
	FTC 223	Graphics	1
			20.5
Second Semester	FTC 205	Forest Mensuration and Statistics II	2
	FTC 209	Forest Roads	2
	FTC 211	Silviculture	2.5
	FTC 214	Personnel Management	1.5
	FTC 215	Timber Harvesting	2
	FTC 217	Forest Management	3.5
	FTC 218	Forest Recreation	1.5
	FTC 219	Elements of Wildlife Ecology	1.5
	FTC 221	Soil and Water Measurements	1.5
	FTC 226	Forest Pathology	1
	FTC 227	Fire Management	2
	FTC 228	Structure and Growth of Trees	1.5
	FTC 229	Silviculture II	
		or	
	FTC 230	Plane Surveying III	2
			24.5

A total of 75 credit hours is required to complete the A.A.S. degree in forest technology.

hours a week of evening and weekend study, daily classes, and laboratory/field exercises. Several short trips are made during the year in connection with courses in dendrology, silviculture, forest management, forest recreation, wildlife ecology, and surveying. Even though the Ranger School's major thrust is in forest technology, surveying is an additional and growing strength of the program.

Surveying Option

When the surveying option is implemented, fall semester coursework will be the same for forest technology and surveying students. In the spring semester, however, students in the surveying option will take 11.5 credit hours of surveying coursework in place of forestry-oriented courses.

Students interested in the surveying option should use the seven credit hours of electives available in the freshman year to take courses in physics, analytic geometry, or introductory calculus.

Information regarding the surveying option may be obtained from the Director of the Ranger School.

Life at Wanakena

The Ranger School of the College of Environmental Science and Forestry is located on the banks of the Oswegatchie River near the hamlet of Wanakena, approximately 65 miles northeast of Watertown, and 35 miles west of Tupper Lake. The program's buildings and its surrounding forest border on the river which flows directly into Cranberry Lake.

The main building consists of a central service unit with dormitory wings on either side. The central unit contains classrooms, laboratories, a student lounge, faculty offices, the library, a kitchen, dining room and 22 double occupancy and 13 single occupancy dorm rooms.

Faculty houses are nearby on the campus. Other buildings include a maintenance shop, garages, a sugar house, and storage buildings.

The close proximity of faculty offices and student quarters and the intensive field work pattern enables students to consult easily and frequently with the faculty. The program considers this traditional close student-faculty association to be of major benefit in its educational program.

A small library of approximately 1,500 volumes consists of highly specialized materials required for the teaching and study programs of the curriculum.

Students taking the second year of the forest technology curriculum at the Ranger School are required to live in the campus's dormitories. An exception may be made for married students who bring their families and rent their own private accommodations in the vicinity. Such accommodations are not plentiful. Each married student should make rental arrangements well in advance of the registration date.

The Ranger School does not maintain an infirmary, nor does it employ a physician or nurse. There are two physicians and a dentist as well as an excellent community hospital in nearby Star Lake, New York. In emergency, situations, the program transports sick or injured students to the local physician of their choice or to the hospital. Health and accident policies for students are available through Syracuse University, and it is strongly suggested that the student consider such coverage before reporting to the campus. Application forms are available through ESF's Office of Student Affairs and Educational Services.

Because of the comparatively isolated location of the Ranger School, a stock of books and supplies used in connection with the second year of the program is maintained on campus for sale to students.

During the first year of the program, students will be guided by the rules and regulations that govern attendance at their local campus. During the second year of the program, students will be guided by the general rules and regulations for College of Environmental Science and Forestry students and an additional set of Ranger School "house rules."

Admission Requirements

Admission into the forest technology curriculum requires the following high school units: English (4 units); social science (3 units); science (2 units, including biology); mathematics (3 units, college preparatory); and electives. Mechanical drawing, technical report writing, and computer science are suggested electives.

In addition to the academic requirements, the following must also be met by all applicants:

1. The applicant must be strongly motivated toward a career in field forestry or surveying.
2. The applicant must be willing and able to meet the physical requirements of the program which include pole and tree climbing, walking 2 to 6 miles through forest areas, often carrying 15 to 20 pounds of equipment, and using a wide array of hand tools and power equipment.
3. The applicant's parents (if the applicant is under 18 years of age) must be fully aware of the field nature of the study program, its rig-

orous study-work regime and supporting academic facilities.

4. A full medical examination report must be submitted.

Questions concerning any of these requirements should be referred to the Director of Admissions.

Admission Procedures

The decision to admit any student to the forest technology program rests solely with the College of Environmental Science and Forestry. Most openings in the program are filled by students who received conditional acceptances while still seniors in high school, contingent on successful completion of the first year of college. Remaining openings are filled by transfer students who have already attended college. Therefore, it is suggested the potential forest technology student, while still a high school senior, follow these procedures:

1. Submit a regular SUNY freshman application for the College of Environmental Science and Forestry, using a Curriculum Code 620 (Forest Technology). These applicants should indicate entry date to be one year in advance of the current year.

2. Submit a regular application to that school selected for the first year of study, using Curriculum Code 620. It is important that students gain entry on their own for the first year of studies. ESF will request information at a later date concerning what institution the student will be attending.

A limited number of outstanding students are admitted directly from high school. For further information, contact the Director of Admissions.

Transfer Students

Students with previous college experience, or students who are currently enrolled at another college, may apply for transfer. However, courses transferred for credit can be applied only to the freshman year course of studies, and they must be comparable in subject matter, content, and level. All second year courses must be taken at the Ranger School, and, therefore, a student cannot transfer any previously earned credit toward the second year. Transfer applicants must submit a recent official copy of their college transcript and a list of courses they anticipate completing prior to enrollment.

Expenses

Cost of the first year will vary with the specific institution attended.

Estimated costs of the second year program at the Ranger School are as follows:

N.Y. Resident		
Tuition	*Board, Room*	*Books, Supplies*
$2,650	$4,950	Approx. $1,000
Nonresident		
Tuition	*Board, Room*	*Books, Supplies*
$6,550	$4,950	Approx. $1,000

An expense of approximately $200 for laundry and clothing should be anticipated. There is also a $20 graduation fee, a student support services fee of $175, a $13 student activity fee, and a Camp Allegany fee of $90. There are a limited number of single dorm rooms available for an additional $200. There is also a $25 resident deposit and a $25 equipment deposit. The latter two fees are fully or partially refundable, depending on breakage charged to a student during the year.

Financial Aid

Financial aid is available upon acceptance to the College of Environmental Science and Forestry. There are three basic loans, scholarships or grants, and part-time employment.

More detailed information on these financial aid opportunities can be found on pages 23-29 of this catalog and the publication Financial Assistance at ESF.

The student must file an application with the Office of Financial Aid at the Syracuse Campus and submit a Family Financial Statement to ACT, Iowa City, Iowa 52243.

Placement

The Ranger School assists in placement of graduates. The excellent reputation which the graduates of the Ranger School at Wanakena have developed in all types of forestry and surveying jobs greatly assists today's graduates to find employment. Employment is common with local, state and federal forestry and land resource agencies, private forestry enterprises, and surveying firms. Positions most frequently filled by recent graduates include: state forest ranger, state forest technician, forest aide, industrial forest district supervisor, timber inventory specialist, timber sales supervisor, forest surveyor, forest engineering aide, forest protection technician, forest research technician, forest equipment salesman, tree service technician, and urban park ranger.

The Faculty of Landscape Architecture

RICHARD S. HAWKS, Chair
331 Marshall Hall
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Faculty: CARTER (Urban Design, City and Regional Planning, Development Process, Planning and Design Theory), CURRY (Site Planning, Urban Analysis and Design, Historic Preservation), FREEMAN (Site Design, Plant Materials, Graphics), HANSELMAN (Communications Strategies and Message Design, Non-Print Communications), HAWKS (Regional Planning and Design, Natural Factors in Design, Geographic Information Systems, University Campus Design and Planning), LEWIS (Community Land Planning; Planning Process, Computer-Aided Community Land Planning, Computer-Aided Mapping, Geographic Information System Applications in Land Planning and Land Use Controls), MARAVIGLIA (Technical Graphics, Creative Problem Solving, Education, Communication, Video, Management), MILLER (Site Design, Graphics, Plant Materials, Provision for Play, Video Simulation), J. PALMER (Landscape Perception, Design Evaluation, Social Impact Assessment, Environment and Behavior Research Methods), POTTEIGER (Cultural Landscape History, History of Landscape Architecture, Design Theory and Methodology), REIMANN (Environmental Design, Passive Energy Conservation, Site Planning and Design), REUTER (Ecology in Landscape Planning, Design and Management of Wetlands; Computer Applications in Environmental Planning and Design Simulation), SHANNON (Site Planning and Design; Urban Analysis and Design; Historic Landscape Preservation Planning; Computer Applications), STRIBLEY (Design and Behavior; Public Participation; Urban Design, Parks and Recreation; Site Planning and Design)

Landscape Architecture

The alteration of the physical environment has been a product of human activity since the earliest times of human settlement. While environments of enduring beauty and vitality occasionally resulted, the history of environmental manipulation more often demonstrated degradation and abuse of the landscape. As the knowledge of natural and human processes has expanded, environmental change has been transformed over the centuries from the casual efforts of many to that requiring skilled individual effort and often demanding multidisciplinary attention.

The Faculty of Landscape Architecture offers two programs designed to educate students to contribute in varied ways to the wise use of land and landscape. Each degree program provides a basis for students to establish career directions in the profession landscape architecture. Both the bachelor and master of landscape architecture are offered.

Support Facilities

The facilities for landscape architecture include individual studio space for each student, office space for funded projects and advanced standing students, a photographic darkroom, PC and Macintosh computer clusters, and a wide assortment of photographic, video, and environmental measurement instrumentation. Computer facilities focus on CAD, GIS, desktop publishing, video image processing, and graphic design and visual simulation systems. The Faculty of Landscape Architecture has one of the most extensive collections of archival material dating from 1913 to the present.

College facilities include a campus library, a fully equipped video recording and processing studio, various environmental measurement laboratories, and a mapping science laboratory with remote sensing, photogrammetry, GIS and digital image processing capabilities. The ESF computer labs contain networked PCs, Macintoshes, work stations and mainframe terminals. All campus computing facilities are linked with Syracuse University for campus-wide support of computing activities.

Bachelor of Landscape Architecture

The B.L.A. program is designed for those students desiring to enter the profession of landscape architecture either directly after completing the degree or after completing graduate school. This is a professional degree with an emphasis on the skills and knowledge required to qualify as a landscape architect. The degree is accredited by the American Society of Landscape Architects (ASLA). The B.L.A. degree is granted at the end of five years of study and requires the successful completion of 160 credit hours. Students enter into the third year of the program with a minimum of 62 lower division credit hours and follow the prescribed curriculum.

The B.L.A. program consists of a core of courses involving the basic principles and skills of land-

scape architecture design, land manipulation and engineering, applied ecology, and communications. Additionally, students are required to participate in an independent study semester, off-campus program, either during the summer between the fourth and fifth years or the fall semester of the fifth year. The off-campus program requires students to cover tuition, books and materials, room and board, and travel cost to the location of study. The major objective of the B.L.A. program is the development of basic proficiency in design, engineering, and communication skills necessary for formal admission into the profession of landscape architecture.

When the prerequisite period of work experience has been completed, a person holding a B.L.A. degree may obtain a license to practice landscape architecture. At present, the State of New York requires those holding a five-year B.L.A. degree to complete a three-year period of internship in the field prior to applying for the licensing examination. Other states have varying requirements for obtaining a license.

As in any area of professional study, students seeking the B.L.A. degree are expected to demonstrate a high level of commitment and scholarship in their studies. This professional commitment is demonstrated by a desire to serve society in an objective, rational, and ethical manner.

Students receiving a B.L.A. degree have entered the profession as employees in public agencies or in private offices offering landscape architectural services. Also, B.L.A. graduates have entered graduate schools in landscape architecture, planning, urban design, regional design, and specific specialties including historic preservation, environmental policy, management, and research.

Prerequisites for Entry into the B.L.A. Degree Program

The breadth of concern of the B.L.A. program makes it imperative that entering students prepare themselves with a broad range of lower division coursework. The environmental efforts with which the students will be involved require a strong background in both the natural and social sciences.

(Cont. on p. 108)

Lower Division Courses

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
Written and Oral Communication	6
Graphics	3
Natural Sciences	6
Social Sciences	3
Mathematics	3
Computer Science	3
Electives	38
Total minimum lower division credits	62

Written and Oral Communication 6
Required credit hours in this area must be taken in courses in English comprehension, the basic skills of grammar and composition, and public speaking.

Graphics 3
A minimum of one course in engineering drawing, mechanical drawing, or architectural drafting is required.

Natural Sciences 6
Required credit hours in this area must include a course in botany or plant biology. Additional hours should be taken from coursework in ecology,* physical geography, earth science, geology, or environmental geology.

Social Sciences 3
Required credit hours in this area are to be taken from coursework in U.S. history, sociology, social psychology, social or cultural anthropology, political science, or economics.

Mathematics 3
Required coverage of college trigonometry. Students with prior coverage in math who can demonstrate proficiency at time of admission may substitute elective hours for this prerequisite. More advanced math is desirable.

Computer Science 3
Introduction to computers with basic application programs including word processing, spread sheets, and data base. Familiarity with microcomputers and programming preferred.

Electives 38

Total minimum lower division credits 62

*Can be waived at ESF if completed prior to transfer.

Upper Division Courses

Third Year — *Credit Hours*

First Semester	ESF 332	Seminar for New Transfer Students	0
	LSA 320	Introduction to Landscape Architecture and Planning	3
	LSA 326	Landscape Architectural Design Studio I	3
	CMN 382	Graphic Communication	3
	LSA 411	Natural Processes in Planning and Design	3
	EFB 320	General Ecology or Elective*	3
			15
Second Semester	LSA 327	Landscape Architecture Design Studio II	3
	LSA 330	Site Research and Analysis	2
	EIN 471	History of Landscape Architecture	3
	EIN 390	Social/Cultural Influences and Environmental Form	3
	ERE 306	Elements of Map and Air Photo Interpretation or Elective*	1
	ERE 308	Elements of Plane Surveying or Elective*	1
	CMN 404	Technical Writing	3
			16

Fourth Year — *Credit Hours*

First Semester	LSA 422	Landscape Design Studio III	4
	LSA 433	Plant Materials	2
	LSA 434	Design Materials	1
	LSA 442	Site Grading	2
	LSA 443	Site Drainage Systems	1
	EIN 371	History of American Landscape Attitudes	3
	Elective		3
			16
Second Semester	LSA 423	Landscape Design Studio IV	4
	LSA 425	Orientation for Experiential Studio	2
	LSA 444	Vehicular Circulation Design	1
	LSA 445	Introduction to Structures	1
	EIN 451	Fundamentals of City and Regional Planning	3
	EIN 470	Art History or Elective*	3
	LIB 300	Library Research	1
	Elective		2
			17
Summer	LSA 533	Plant Materials	2

Fifth Year — *Credit Hours*

First Semester	LSA 524	Experiential Landscape Design Studio V (Off-Campus Program)	16
Second Semester	LSA 522	Landscape Design Studio VI—Urban Design	4
	or		
	LSA 525	Landscape Design Studio VI—Site Design	4
	or		
	LSA 527	Landscape Design Studio VI—Regional Design	4
	LSA 545	Professional Practice Studio	3
	LSA 455	Professional Practice in Landscape Architecture	2
	Architecture Elective		3
	Elective		4
			16

*Elective only with prior coverage in required area.
A total of 160 credit hours is required to complete the B.L.A. degree.

In addition, prior skill development in graphics, mathematics, and computer science is required.

The required prerequisite coursework described on page 106 must be met to prepare the entering student to engage the B.L.A. curriculum.

Elective Guidelines

Students planning to transfer to the bachelor of landscape architecture program should consider the following as guidelines in selecting their 38 credit hours of electives. The following subject areas are considered highly desirable. Course areas marked (*) are required following transfer to the program, but can be waived if completed prior to transferring. This will allow a student to take additional electives at ESF.

1. In addition to the required prerequisite credit hours listed, further subject coverage in written and oral communications, natural sciences, and social sciences as listed is recommended.
2. Art and Design
   Courses in this category should include art history* and studio art. Studio courses in drawing or three-dimensional design, sculpture, ceramics, and photography, are recommended.
3. Analytical Tools
   Courses in this category should include elementary plane surveying*, air photo interpretation*, or elementary physics. Additional work in computing technology is highly recommended, particularly in the realm of computer graphics and computer-assisted design (CAD).

Demonstration of academic excellence in environmental design and design graphics through submission of a portfolio is highly recommended as part of the admission's process to the B.L.A. program.

BLA/MLA Fast Track

This program is available to outstanding fourth-year bachelor of landscape architecture students and provides the opportunity to receive both the bachelor of landscape architecture and master of landscape architecture degrees during a four-year period at the College. Students who apply must have a minimum 3.000 G.P.A. and are accepted into the program during the fall semester of the fourth-year of the bachelor of landscape architecture program. During spring semester the transition begins between the bachelor of landscape architecture and master of landscape architecture curriculum requirements. Both degrees are awarded at the completion of 190 credit hours (62 lower division credit hours transferred to the College upon entering the bachelor of landscape architecture third-year and 128 credit hours earned at the College).

Master of Landscape Architecture

The master of landscape architecture (M.L.A.) degree is fully accredited by the American Society of Landscape Architects (ASLA). When the prerequisite period of work experience has been completed, anyone holding a M.L.A. degree may apply to take the Landscape Architecture Registration Examination (LARE).

The M.L.A. degree is attractive to a broad range of people—those with undergraduate degrees in landscape architecture who seek specialized training or an academic career option, those with degrees in related design and planning fields (such as, architecture, urban and regional planning, and environmental design) who wish to broaden or redirect their design and planning skills, and those with degrees in fields less closely related to landscape architecture (such as, general humanities, arts and sciences) who seek new career options or wish to apply prior interests through a licensed design and planning profession. In response to these differing educational backgrounds, three curriculum tracks are provided: (1) a two-year program for applicants with a previous landscape architectural degree, (2) a two and one-half year program for applicants with related design and planning degrees, and (3) a three-year program for applicants with degrees unrelated to landscape architecture. There is also a fast-track program that enables qualified candidates within the B.L.A. program to proceed directly into the M.L.A. program and finish both degrees concurrently. Refer to the previous section for information on the fast-track option.

The educational vision of the graduate program is to provide a well-balanced general professional practice curriculum in landscape architectural design and planning, coupled with opportunities to pursue individualized advanced study in a broad range of topics. Faculty interests and expertise include environmental and land planning, urban design, site design, human behavior studies, historic preservation, cultural landscape resource planning, visual landscape assessment, design simulation, wetland assessment and mitigation, applied ecology and vegetation management, rural community planning, and computer applications entailing: (1) computer-aided drawing and design (CAD), (2) geographic information systems (GIS), (3) video and digital image processing, (4) desktop publishing (DTP), and (5) other general and technical applications. Major areas of recent research activity include historic landscape preservation, visual analysis, and rural town planning. Funding for this research is sponsored by federal and state agencies such as the National Park Service, the National Endowment for the Arts, and the

U.S. Forest Service. Educational opportunities are enhanced further with the inclusion of expertise from allied faculty from ESF and Syracuse University.

M.L.A. Students With A Previous Landscape Architectural Degree

This is a two-year degree track for individuals possessing an undergraduate degree in landscape architecture from an ASLA accredited program. The credit hours required for graduation will vary depending on the integrative experience selected and any advanced standing granted for previous professional practice.

The two-year degree track is for students who seek the challenge of advanced study in the field of landscape architecture. The track has few required courses other than those determined by the major professor and graduate steering committee as essential to a student's chosen area of interest. Curriculum plans are individualized and direct students toward achieving advanced skills in the field. The main thrust is to allow students to customize their study and focus on specialized knowledge they wish to gain.

Students are expected to enter this track with specific academic goals that define their area of specialization. During their first semester, students are expected to select a major professor and prepare a degree plan outlining their academic program and final integrative experience. Domestic students are required to complete 6 to 12 credit hours of thesis or project as their final integrative experience, while international students, for whom English is a second language, are encouraged to pursue internship or coursework integrative experiences.

M.L.A. Students With A Related Design and Planning Degree

This is a two and one-half year degree track requiring 56 credit hours of graduate work for individuals with related design and planning degrees (e.g., architecture, urban design, environmental design, regional planning, etc.). Credit requirements may be reduced for individuals with professional design experience and a design portfolio. Degree requirements may also exceed 56 credit hours for international students and those with weak credentials in graphics, design, construction, and design practice.

The two and one-half year track is for students who seek to broaden or redirect their design and planning skills to include practice in landscape architecture. The academic program for this track is very similar to the three-year track, with introductory design, graphics, and professional practice coursework eliminated for those with relevant background. The emphasis on the required coursework is to establish the historical, theoretical, and technical design skills expected for licensure as a professional landscape architect. However, students are expected to pursue advanced study in an area of their interest with a major professor and graduate steering committee of their choice. The main thrust of this track, therefore, includes both primary training as a professional landscape architect and expectations of graduate level advanced study in the field.

Students are expected to explore various aspects of the field for their first year, then select a major professor during their third semester and prepare a degree plan outlining their academic program and final integrative experience. Domestic students may select thesis, project, internship, or coursework final integrative experiences, while international students, for whom English is a second language, are encouraged to pursue internship or coursework integrative experiences.

M.L.A. Students With No Previous Professional Design or Planning Degree

The M.L.A. three-year, 66 credit hours, degree track is the academic program accredited by ASLA as the "first professional degree." It is for students with no prior background in design and planning who seek new career options in landscape architecture. This track has two full years of required coursework emphasizing historical, theoretical, and technical design skills expected for licensure as a professional landscape architect. However, the student is expected to pursue advanced study in an area of their interest during the third year. The main thrust, therefore, includes both primary training for practice in landscape architecture and expectations of graduate level advanced study in the field.

Students are expected to explore various aspects of the field for their first three semesters, then select a major professor during their fourth semester and prepare a degree plan outlining their academic program and final integrative experience. Domestic students may select thesis, project, internship, or coursework final integrative experiences, while international students are encouraged to pursue internship or coursework integrative experiences.

Final Integrative Experience

All graduate students are expected to complete a final integrative experience as the advanced study

The following schedule of courses illustrates a typical three-year program.

First Year — *Credit Hours*

CMN 552[1]	Graphic Communication	3
LSA 320[2]	Introduction to Landscape Architecture	A
LSA 433	Plant Materials	2
LSA 600[1]	Design Studio I—Introductory Design	4
LSA 601	Design Studio II—Site Design	4
LSA 611	Natural Factors Analysis	3
LSA 615	Introduction to Site Construction	3
LSA 640	Research Methodology	3
LSA 671	History of Landscape Architecture	3
LSA 697	Topics and Issues of Landscape Architecture	1
Directed Electives[3]		Varies
		26

Second Year — *Credit Hours*

LSA 620	Design Studio III—Advanced Site Design	4
LSA 621	Design Studio IV—Community Design and Planning	4
LSA 650	Behavioral Factors of Community Design	3
LSA 652	Community Development and Planning Process	3
LSA 654	Ecology in Landscape Design and Planning	3
LSA 655	Professional Practice	4
LSA 799	Proposal for Thesis/Project or Internship	1
Directed Electives[3]		Varies
		22

Third Year — *Credit Hours*

LSA 700[4]	Design Studio V—Integrative Studio	4
Integrative Experiences, Program Alternatives:		
LSA 898/899[5]	Professional Experience/Thesis or Project	6-12
Directed Electives [3]		Varies
		18

[1]May be waived for students with undergraduate design degrees based on portfolio review.

[2]Audited concurrently with LSA 697.

[3]Directed electives are selected in consultation with the student's major professor to complete credit hour requirements. They are to support advanced graduate study or, in some cases, to compensate for academic deficiencies. A coursework integrative experience uses directed electives to fulfill the advanced study requirements of the degree.

[4]Required studio for professional experience and coursework program alternatives.

[5]The precise number of credit hours taken by a student in LSA 898, LSA 899, during a given semester is determined in consultation with the student's major professor.

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component of their program. Alternatives for this integrative experience include: (1) thesis or project, (2) internship, and (3) coursework. A thesis is the culmination of research in which new, original knowledge is generated, while a project focuses instead on the application of existing knowledge to a new situation. Internships entail a learning experience through a public agency, non-profit organization, or private professional firm that enhances the educational program of the individual student. Coursework is the pursuit of a body of knowledge through completion of supporting elective classes.

In concert with specific program requirements, each student should be aware the College requires all master's degree students to complete a minimum of 30 credit hours at the graduate level while pursuing the thesis/ project, or professional experience options, or a minimum of 42 credit hours at the graduate level for those pursuing the coursework option. A student could, therefore, be accepted into the M.L.A. program requiring 36 credit hours to satisfy re-

quirements, and still need 42 graduate-level credit hours to complete degree requirements if the coursework option were chosen.

Prerequisites and Admission Requirements

Students seeking admission to the M.L.A. program may apply to enter based on education and experience. Admission requires:

1. An undergraduate degree
2. Graduate Record Examination scores
3. A minimum 3.000 (4.000=A) cumulative grade point average is generally required for admission. However, other circumstances may be considered (e.g., work experience) for those below this standard.
4. Three letters of recommendation.
5. A completed course is recommended in each of the following six areas:
   a. botany, biology, or ecology
   b. geology, geomorphology, or earth sci ence
   c. anthropology, psychology, or sociology
   d. computer applications
   e. drawing, drafting
   f. art or architecture history

Students seeking admission to the two year and two and one-half year degree tracks must additionally have:

1. An accredited or recognized design or planning degree with a minimum 3.000 (4.000=A) cumulative grade point average. However, other circumstances may be considered (e.g., work experience) for those below this standard.
2. A design portfolio

Applicants may be assessed as deficient in one or more areas deemed important to their admission to graduate study in the program. Courses taken to make up deficiencies (e.g., English for international students) may not count towards the credit hours required for the graduate degree.

Applications should be made prior to March 15 for fall admission. Visits to the College are encouraged and highly recommended.

Research and Community Service

Research and community service are important aspects of the graduate experience in landscape architecture. Students may participate in the funded studies directed by individual faculty, or in unique studies of their own design. Furthermore, many community service projects are performed in the context of a design studio, thereby bringing real world problems into the studio as a learning experience. In this way, the on-going efforts of students and faculty help to further develop the body of knowledge of the field, while providing a challenging academic environment for the students.

The Faculty of Landscape Architecture believes that computer and video technologies are very important to the future of the profession. They are committed to exploring the application of digital technologies to the practice of landscape architecture, and encourage the use of these technologies by the students. Advanced students may choose to specialize in the application and integration of computer technologies as part of their final integrative experience.

College and Regional Context

Students in the graduate program in landscape architecture have an excellent opportunity to draw upon the extensive college expertise in ecology, natural sciences, resources management, engineering, forestry, and many other environmental disciplines. Add to this the resources available through Syracuse University, like architecture, geography, and the Maxwell School of Public Affairs, and the breadth of academic choices offered to a student at ESF becomes very significant.

The City of Syracuse has the largest concentration of professional landscape architectural offices in the Central New York State region. This centralized location also provides easy access to major metropolitan centers like, Toronto, Montreal, New York, Boston, and Buffalo, and to unique rural and natural landscapes, such as Lake Ontario, the Catskill and Adirondack Mountains. Basic geography, therefore, provides the student with a wide diversity of natural and cultural contexts in which to pursue academic and career goals.

Graduate Assistantships

Students with associated professional degrees may be considered for a graduate assistantship (stipend and tuition scholarship) upon admission, depending upon qualifications and portfolio. Other students may apply for landscape architecture graduate assistantships after the first year of the first professional degree track. Assistantships may also be available with community service or research projects, and are awarded by individual faculty to students with the necessary qualifications.

A limited number of teaching assistantships are awarded each year to highly qualified candidates seeking an academic career. Individuals with prior landscape architectural work experience who intend to pursue a career in teaching at the university level are encouraged to discuss their options with the graduate program coordinator in the Faculty of Landscape Architecture.

The Faculty of Paper Science and Engineering

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(315) 470-6502

LELAND R. SCHROEDER, Chair (Organic Chemistry, Pulping, Bleaching) BAMBACHT (Pulping, Papermaking, Paper Machine Operation), CROSBY (Paper Properties and Microscopy), EUSUFZAI (Paper Properties and Sheet Morphology), FRANCIS (Chemical Engineering and Pulping), HOLM (Water and Air Pollution Abatement, Computer Simulation), HOLTZMAN (Papermaking, Paper Machine Operations), JELINEK (Computer Applications, Process Engineering, Thermodynamics), LAI (Organic Chemistry, Pulping, Bleaching), LUNER (Surface and Colloid Chemistry of Papermaking Systems), MARK (Mechanical Properties of Fibers and Paper), RAMARAO (Chemical Engineering, Instrumentation, Flow Phenomena, Process Control), THORPE (Fiber Physics, Paper Physics and Mechanics)

Paper science and engineering provides a broad base of study to prepare men and women for professional positions in the pulp and paper industry. This industry is the fifth largest in the nation and is very strong internationally. The College pioneered instruction for the pulp and paper and allied industries in 1920 with the formation of a paper science and engineering department which has maintained a singularly high position in this area of professional education. This program has a longstanding reputation for preparing graduates for rewarding positions as research chemists, process engineers, technical service representatives, managers, and many others. Graduates have advanced to positions of leadership in research, management, technical operations, and sales in the pulp and paper industry as well as allied industries of heavy equipment manufacture, process chemicals, and other supply industries.

The program provides education in the physical sciences and chemical engineering, with specific emphasis on those aspects of these disciplines which relate to the manufacture of pulp and paper. This includes the chemistry and anatomy of wood, the conversion of wood to pulp and paper, and the chemistry and physics of paper and paper formation. All options include the basics of chemical engineering with a foundation of unit operations and specialized courses, for example, in air and water pollution abatement for the pulp and paper industry. The engineering option extends this foundation to present a chemical engineering education tailored specifically to the pulp and paper industry.

Paper science and engineering is located in Walters Hall, the facilities of which are devoted to education and research in the field of pulp and paper. In addition to a large number of special purpose laboratories and highly sophisticated scientific equipment, there is an experimental pulp and paper mill equipped with machinery and instrumentation for studies of pulping, pulp purification, recycling, refining, paper additives and papermaking. Equipment includes two complete paper machines, one 48-inch and one 12-inch, a pressurized refiner for mechanical pulping, and auxiliary equipment. An environmental engineering laboratory is designed to research various methods of paper recycling and waste treatment. A new state-of-the-art laboratory for testing paper and other materials is in service. The environmental controls for this laboratory provide a wide range of humidities with exceptional accuracy. This equipment as well as the extensive chemical engineering laboratory is employed for both education and research. Computer hardware and software is continually updated for teaching and research in process control and simulation.

Undergraduate Program

The curriculum may be entered at the freshman level by high school graduates with appropriate backgrounds, or at the junior level by students having an associate degree in engineering science, chemical technology, or science and mathematics. The engineering science associate degree is well suited to the engineering option. Some latitude is available if the student's background includes most of the courses shown under "Lower Division Courses." The opportunity is also available to enter with fewer background courses if the student plans to extend his or her stay at the College. The student may elect to extend the time to complete the program by use of a cooperative work-study plan to help in financing the education as well as to gain experience to help in shaping a future career. All students are required to complete a 12 week intern program in the industry (PSE 304). The experi-

ence and financial return are valuable benefits. The student can also qualify for a full-tuition scholarship from the Syracuse Pulp and Paper Foundation.

The Science Option

The science option consists mainly of chemistry and chemical engineering courses and specialized courses relating to the manufacture and use of pulp and paper products. The technical elective concentration allows the student to select a subject area of interest in which to specialize. This option prepares the student for careers in the technical, management, or technical representative areas with opportunities to extend interests in other directions.

Lower Division Courses

Students entering this program through the freshman admissions option should refer to page 55.

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	*Credit Hours*
Botany or Biology with Laboratory	4
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory	8
Quantitative Analysis	3
Physics with Laboratory	8
Mathematics—Calculus I, II, III and/or Differential Equations	12
Computer Science	3
Economics	3
English	6
Engineering Drawing	1
Humanities or Social Science Electives	8
Total minimum lower division credits	64

Upper Division Courses

Science Option

Junior Year

			Credit Hours
First Semester	ESF 332	Seminar for New Transfer Students	0
	FCH 360	Physical Chemistry I	3
	FCH 572	Wood Chemistry II	3
	PSE 300	Introduction to Papermaking	3
	PSE 370	Principles of Mass and Energy Balance	3
	PSE 371	Fluid Mechanics	3
	PSE 496	Special Topics (Technical Writing)	2
	LIB 300	Library Research Methods	1
			18
Second Semester	FCH 361	Physical Chemistry II	3
	PSE 386	Structure and Properties of Wood	2
	WPE 390	Fiber Identification Laboratory	1
	PSE 301	Pulp and Paper Processes	3
	PSE 372	Heat Transfer	3
	Electives *		6
			18

Summer Mill Experience:

Twelve weeks of full-time pulp and/or paper mill employment approved by the Faculty, PS 304 2

Senior Year

			Credit Hours
First Semester	PSE 461	Pulping Technology	3
	PSE 465	Paper Properties	4
	PSE 473	Mass Transfer	3
	PSE 477	Process Control	3
	PSE 491	Paper Science and Engineering Project I	1
	Elective*		3
			17
Second Semester	PSE 466	Paper Coating and Converting	2
	PSE 468	Papermaking Processes	3
	ERE 440	Water Pollution Engineering	3
	Electives *		6
			14
	Total minimum upper division credits		69

*At least 9 credit hours of electives must be selected from an advisor-approved sequence of technical courses. Examples of acceptable elective concentration areas are shown below.

Colloid and Surface
Polymer Chemistry
Applied Mathematics
Management
Engineering Design
Independent Research Project
Chemistry Instrumental Analysis
Pollution Abatement
Computer Modeling
Mechanics
Materials Science

A total minimum of 133 credit hours is required to complete the B.S. degree in the PSE science option.

Management Minor

Junior Year

			Credit Hours
First Semester	ESF 332	Seminar for New Transfer Students	0
	FCH 360	Physical Chemistry I	3
	FCH 572	Wood Chemistry II	3
	PSE 300	Introduction to Papermaking	3
	PSE 370	Principles of Mass and Energy Balance	3
	PSE 371	Fluid Mechanics	3
	PSE 496	Special Topics —Technical Writing	2
	LIB 300	Library Research Methods	1
			18
Second Semester	FCH 361	Physical Chemistry II	3
	WPE 386	Structure and Properties of Wood	2
	WPE 390	Fiber Identification Laboratory	1
	PSE 301	Pulp and Paper Processes	3
	PSE 372	Heat Transfer	3
	FOR 360	Principles of Management	3
	Elective *		3
			18

Summer Mill Experience:

Twelve weeks of full-time pulp and/or paper mill employment approved by the Faculty, PSE 304 2

Senior Year *Credit Hours*

First Semester	PSE 461	Pulping Technology	3
	PSE 465	Paper Properties	4
	PSE 473	Mass Transfer	3
	PSE 477	Process Control	3
	PSE 491	Paper Science and Engineering Project I	1
	Elective		3
			17
Second Semester	PSE 456	Management in the Paper Industry	3
	PSE 466	Paper Coating and Converting	2
	PSE 468	Papermaking Processes	3
	ERE 440	Water Pollution Engineering	3
	Elective *		3
			14
	Total minimum upper division credits		69

*At least 9 credit hours of electives must be used to complete the following courses: FIN 355 Money and Banking, LPP 255 Introduction to the Legal System, and either MAR 355 Marketing and Society or PIR 355 Introduction to Personnel.

A total minimum of 133 credit hours is required to complete the B.S. degree in PSE with a management minor.

Engineering Option

Junior Year *Credit Hours*

First Semester	ESF 332	Seminar for New Transfer Students	0
	FCH 360	Physical Chemistry I	3
	FCH 572	Wood Chemistry II	3
	PSE 300	Introduction to Papermaking	3
	PSE 370	Principles of Mass and Energy Balance	3
	PSE 371	Fluid Mechanics	3
	PSE 496	Special Topics (Technical Writing)	2
	LIB 300	Library Research Methods	1
			18
Second Semester	FCH 361	Physical Chemistry II	3
	WPE 386	Structure and Properties of Wood	2
	WPE 390	Fiber Identification Laboratory	1
	PSE 301	Pulp and Paper Processes	3
	PSE 372	Heat Transfer	3
	APM 395	Probability and Statistics for Engineers	3
			15

Summer Mill Experience:

Twelve weeks of full-time pulp and/or paper mill employment approved by the Faculty, PSE 304 2

Senior Year — *Credit Hours*

First Semester	PSE 361	Engineering Thermodynamics	3
	PSE 465	Paper Properties	4
	PSE 473	Mass Transfer	3
	MEE 225	Statics and Dynamics	4
	ELE 221	Electrical Network Theory	3
			17
Second Semester	PSE 466	Paper Coating and Converting	2
	PSE 468	Papermaking Processes	3
	PSE 480	Process and Plant Design I: Analysis	3
	ERE 440	Water Pollution Engineering	3
	CIE 325	Mechanics of Deformable Bodies	3
	ELE 394	Electrical Network Laboratory	1
			15

Fifth Year — *Credit Hours*

First Semester	PSE 461	Pulping Technology	3
	PSE 477	Process Control	3
	PSE 481	Process and Plant Design II: Synthesis	3
	Elective *		3
			12
	Total minimum upper division credits		79

A total minimum of 143 credit hours is required to complete the B.S. degree in the PSE engineering option.

The Management Minor

The management minor was developed from the science option by concentrating the electives in management-specific courses. The student, therefore, combines a strong technical background with a firm base in management. The student should have completed a course in microeconomics and an accounting course prior to entering the junior year. The management minor can be taken in conjunction with either the science or engineering options.

The Engineering Option

The engineering option has been designed to provide an accreditable chemical engineering education for the student preparing for an engineering career in the pulp and paper industry. The courses are designed to present the principles of engineering with the disciplines and examples selected especially for the pulp and paper industry. Courses have been added in the areas of basic principles in electricity, statics and dynamics, and mechanics, as well as thermodynamics and design. The graduate is prepared to move into assignments in the engineering field and advance quickly to positions of responsibility in the analysis and design of processes and equipment. The engineering option is especially flexible in terms of extending the course of study to fit individual backgrounds.

The student who enters the junior year with all lower division requirements in place, will need to make the choice between the engineering and science options prior to entering the fall semester of the senior year. Either option will serve as excellent preparation for graduate study.

Graduate Opportunities

The faculty participates in graduate education leading to the master of science and doctor of philosophy degrees through the program in environ-

mental and resource engineering. See page 59 for more information on this program.

Graduate studies reflect the strong trend toward diversification in the industry and offer opportunities for study in a variety of subjects related to the manufacture of pulp and paper. Individual study programs are designed to meet specific personal needs.

An important component of the graduate program is thesis research under direction of a major professor. Much of this research is carried out under the auspices of one of the outstanding research facilities of the world, the Empire State Paper Research Institute (ESPRI), an integral part of the Faculty. Its research activities aim to generate new information regarding the fundamentals, the science, the engineering and the technology of the papermaking process, utilizing advanced techniques such as computer simulation, electron microscopy, specialized spectrophotometry, nuclear magnetic and electron spin resonance and nuclear tracer methods. Recent work has been directed to fundamental investigations of pulping, bleaching, additives, paper recycling, effluent disposal, the papermaking process, the properties of paper, reactions of wood components during mechanical and chemical treatments, the structure of wood and wood fibers, evaporation, fluid dynamics, heat transfer, and chemical recovery. Pilot scale equipment in Walters Hall is often used as an integral part of these research programs.

Many research projects are carried out in cooperation with other College faculties. Examples of such projects include a wide-ranging study of toxicity of paper industry effluents in cooperation with the Faculty of Environmental and Forest Biology, and a cooperative project on the theoretical and experimental analysis of the mechanical properties of fiber and paper with the Department of Aerospace and Mechanical Engineering at Syracuse University. Cooperative studies enable access to the latest equipment in the computer field, including "super" computers.

The faculty enjoys excellent external support in the form of graduate assistantships, fellowships, and grants from ESPRI, the Syracuse Pulp and Paper Foundation, and other industry sources, as well as a number of government granting agencies.

The Faculty of Wood Products Engineering

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LEONARD A. SMITH, Chair (Adhesives, Coatings, Wood-based Composites), HANNA (Ultrastructure and Microscopy), HUSSEIN (Structural Engineering, Mechanics of Materials), KEULER (Construction Estimating, Safety, Codes and Zoning, CAD), KYANKA (Construction, Applied Mechanics, Engineering Design), MEYER (Wood Properties, Anatomy), RESCH (Wood Physics, Manufacturing), SALGADO (Construction Management, Cost Engineering, Scheduling), W. SMITH (Wood Preservation and Seasoning)

Undergraduate Program

The wood products engineering program prepares students for a wide variety of professional careers in construction management, wood products manufacturing, marketing, or the use of wood as a material. These interests are presented in two options: construction, and wood products. Instruction is tailored to the interests of individual students through the use of electives taken at both ESF and Syracuse University.

Professional growth of students is stimulated by active membership in student chapters of professional organizations. Students are encouraged to join an organization that is of particular interest to them. The following student chapters are on campus: the Society of Wood Science and Technology, the Forest Products Research Society, and the Student Construction Association (affiliated with The Associated General Contractors of America and General Building Contractors).

To enter either option at the junior level, a transferring student must have acceptable college credit in the coursework areas listed below. Students who have completed a pre-calculus course, but have not completed chemistry and/or physics may apply for the five-semester program.

Construction Option

The commercial construction industry represents an important segment of the nation's GNP. A consequence of this economic importance is that the industry is very competitive. With more construction firms bidding on jobs, it is the organization with the best prepared professionals using the latest technology which usually is the successful bidder. This competition applies not only to contractors, but to others who are involved in construction operations; e.g., engineers, human resource managers, and material and equipment suppliers. People engaged in this industry must have

Lower Division Courses[1]

Students entering through one of the transfer programs should follow the curriculum described below.

Course Area	Credit Hours
Written and Oral Communication	6-9
English Comprehension, Composition, Public Speaking, or Technical Writing	
Social Sciences	3-9
Economics, Sociology, Psychology, Ethics, or Human Relations	
Mathematics—Calculus I and II	6
Chemistry I with Laboratory	4
Physics I with Laboratory	4
Liberal Arts and Sciences	Up to 19
Philosophy, Art, History, Languages, Literature, Political Science, Biology, Geology, Statistics, or Computer Science	
Professional Studies	Up to 40
Design, Technology, Management, or Graphics	
Total minimum lower division credits	62

[1] Sophomores who wish to transfer with fewer than 62 credits should contact the Admissions Office.

state-of-the-art skills and knowledge to be successful.

The construction option prepares students for management and engineering careers in the construction industry. The basic objective of the construction option is twofold: first, to provide a fundamental understanding of the engineering considerations which comprise the facility design; and second, to demonstrate the various methods used to take the design into the field and produce a quality product in the most efficient and effective manner.

Particular attention is given to the study of engineering practices. Students learn the behavior of such construction materials as timber, steel, concrete, soil, and rock. Analysis and design of various structural functions are studied, including buildings, excavations, foundations, and waterfront structures. Courses include construction safety, construction equipment, light construction, construction methods, building codes and zoning, specifications, planning and scheduling, estimating, and construction management.

Quality, economic use, and behavior of the materials are stressed throughout the curriculum. Legal and social aspects are integrated into the program in the later stages.

Graduates of the construction option are well prepared for careers in a very challenging and dynamic field. Positions held by alumni include:

- Construction Manager
- Project Manager
- Project Engineer
- Cost Engineer
- Construction Engineer
- Field Engineer
- Planning/Scheduling Engineer
- Timber Engineer
- Truss Design Engineer

Students may complete this option in four or five semesters.

Wood Products Option

Students selecting this option may elect a concentration in marketing/production management, or wood science. These elective concentrations build upon a core set of courses designed to develop a comprehensive knowledge and understanding of wood and wood products. Students meet individually with their faculty advisors to discuss their career goals and prepare a study plan. Students may complete this option in four or five semesters.

Marketing/production management. Students choosing this elective concentration select courses from ESF and Syracuse University's School of Management. They usually intend to enter the purchasing, marketing, or cost analysis fields. Job titles of recent graduates include:

- Export Trade Analyst
- Technical Sales Representative
- Marketing Research Analyst

An understanding of the material properties of wood and the suitability of specific wood species for use in various products enables graduates with a marketing/production management concentration to assist customers in the selection of the correct wood product for the intended end use, or to advise on the procurement of the best wood raw material for manufacturing operations. The issues involved include, for example, considering the correct species of wood, treatments to prolong the service life of a wood product, and selection of the most suitable manufactured product for a specific application. A special knowledge of the material properties of wood, its durability, behavior under various conditions of temperature and relative humidity, and the characteristics of different species and types provides graduates with the ability to make sound judgements on the various parameters involved in the manufacture and use of wood products. Job titles of recent graduates include:

- Quality Control Engineer
- Plant Engineer
- Production Supervisor

Wood science. This elective concentration focuses on the technology and scientific disciplines required for an intimate understanding of wood use, including chemistry, physics, plant anatomy, and engineering. At ESF, this elective concentration prepares students for careers in technical services, product development, and graduate study leading to teaching or research at the university level. Graduates who pursue a technical service career use their knowledge of wood to enhance the efficiency of operations in chemical or machined manufacturing, or consult with industry in technical fields such as lumber production, preservative treatment, or panel production. Those students who choose wood science select biological, chemical, and/or physical science courses at ESF and Syracuse University. Advanced courses in wood science and wood technology are also available.

Wood science uses materials science and engineering to increase the efficiency of wood, apply existing or new knowledge to wood product manu-

(Cont. p. 123)

Upper Division Courses
Construction Option
4-Semester Sequence

Junior Year — *Credit Hours*

Fall Semester	ESF	332	Seminar for New Transfer Students	0
	ERE	221	Engineering Mechanics-Statics	3
	ERE	371	Surveying	3
	WPE	342	Light Construction	3
	WPE	387	Wood Structure and Properties	3
	Elective			3
				15
Spring Semester	APM	391	Statistical Analysis	3
	ERE	362	Mechanics of Materials	3
	ERE	364	Engineering Materials	3
	WPE	343	Construction Estimating	3
	General Elective[1]			6
				18
Summer	WPE	399	Field Trip (a one-week field trip immediately following the final examination period):	1

Senior Year — *Credit Hours*

Fall Semester	CIE	337	Soil Mechanics I	3
	FEG	410	Structures	4
	WPE	350	Construction Methods and Equipment	3
	WPE	453	Construction Planning and Scheduling	3
	WPE	497	Senior Seminar	2
				15
Spring Semester	WPE	454	Construction Project Management	3
	WPE	455	Construction Contracts and Specifications	3
	Construction Technical Elective[2]			3
	General Elective[1]			3
	Wood Technical Elective[3]			3
				15

Construction Option
5-Semester Sequence

Junior Year — *Credit Hours*

Fall Semester	ESF	332	Seminar for New Transfer Students	0
	MAT	285	Calculus I	3
	PHY	211	Physics I	3
	PHY	221	Physics I Lab	1
	WPE	342	Light Construction	3
	WPE	387	Wood Structure and Properties	3
	General Elective[1]			3
				16
Spring Semester	APM	391	Statistical Analysis	3
	MAT	286	Calculus II	3
	WPE	343	Construction Estimating	3
	Elective/Computer			3
	General Elective[1]			3
				15
Summer	WPE	399	Field Trip (a one-week field trip immediately following the final examination period):	1

Senior Year

				Credit Hours
Fall Semester	CHE	106	General Chemistry	3
	CHE	107	General Chemistry Lab	1
	ERE	221	Engineering Mechanics-Statics	3
	ERE	371	Surveying	3
	WPE	453	Construction Planning and Scheduling	3
	WPE	350	Construction Methods and Equipment	3
				16
Spring Semester	ERE	362	Mechanics of Materials	3
	ERE	364	Engineering Materials	3
	WPE	454	Construction Project Management	3
	WPE	455	Construction Contracts and Specifications	3
	Wood Technical Elective[3]			3
				15
Fall Semester	CIE	337	Soil Mechanics I	3
	FEG	410	Structures	4
	WPE	497	Senior Seminar	2
	Construction Technical Elective[2]			3
	Elective			3
				15

[1] *General Electives:* FOR 205 Introduction to Macroeconomics, FOR 206 Introduction to Microeconomics, FOR 363 Management Models, WPE 401 Creative Approaches to Management. Additional courses in liberal arts and sciences may be required.

[2] *Construction Technical Electives:* CIE 332 Structures II, CIE 338 Soil Mechanics II, WPE 330 Building Codes and Zoning Practices, WPE 332 Mechanical and Electrical Equipment, WPE 335 Cost Engineering, WPE 404 Timber Design Project, WPE 413 Computer-Aided Senior Project, or WPE 414 Computer Applications in Engineering.

[3] *Wood Technical Electives:* WPE 326 Fluid Treatments, WPE 404 Timber Design Project, WPE 420 Adhesives, Sealants and Coatings, WPE 422 Composite Materials.

A total of 126 credit hours is required to complete the B.S. degree in wood products engineering with the construction option.

Wood Products Option

4-Semester Sequence

Junior Year

				Credit Hours
Fall Semester	ESF	332	Seminar for New Transfer Students	0
	EFB	335	Dendrology	2
	ERE	221	Engineering Mechanics-Statics	3
	WPE	322	Mechanical Processing	3
	WPE	387	Wood Structure and Properties	3
	WPE	388	Wood and Fiber Identification Laboratory	2
	Elective			3
				16
Spring Semester	ERE	362	Mechanics of Materials	3
	WPE	326	Fluid Treatments	2
	WPE	327	Fluid Treatments Laboratory	1
	WPE	342	Light Construction	3
	Elective Concentration Course*			3
	Statistical Analysis			3
				15
Summer	WPE 399		Field Trip (a one-week field trip immediately following the final examination period):	1

Senior Year *Credit Hours*

Fall Semester	WPE	404	Timber Design Project	3
	WPE	420	Adhesives, Sealants, and Coatings	3
	WPE	497	Senior Seminar	2
	Elective Concentration Courses*			6
	Elective Course			3
				17
Spring Semester	FOR	404	Economics of Wood-Using Industries	3
	WPE	422	Composite Materials	3
	Elective Concentration Courses*			6
	Elective Course			3
				15

Wood Products Option

5-Semester Sequence

Junior Year *Credit Hours*

Fall Semester	ESF	332	Seminar for New Transfer Students	0
	CHE	106	General Chemistry	3
	CHE	107	General Chemistry Lab	1
	EFB	335	Dendrology	2
	MAT	285	Calculus I	3
	WPE	387	Wood Structure and Properties	3
	WPE	388	Wood & Fiber Identification Lab	2
				14
Spring Semester	MAT	286	Calculus II	3
	PHY	211	General Physics	3
	PHY	221	General Physics Lab	1
	WPE	326	Fluid Treatments	2
	WPE	327	Fluid Treatments Lab	1
	WPE	342	Light Construction	3
	Elective Course			3
				16
Summer	WPE 399		Field Trip (a one-week field trip immediately following the final examination period):	1

Senior Year *Credit Hours*

Fall Semester	ERE	221	Engineering Mechanics-Statics	3
	WPE	332	Mechanical Processing	3
	WPE	420	Adhesives, Sealants, and Coatings	3
	Elective Concentration Course*			3
	Elective Course			3
				15
Spring Semester	ERE	362	Mechanics of Materials	3
	FOR	404	Economics of Wood-Using Industries	3
	WPE	422	Composite Materials	3
	Elective Concentration Courses*			6
				15

Fall Semester	WPE	404	Timber Design Project	3
	WPE	497	Senior Seminar	2
	Elective Concentration Course*			3
	Elective Courses			6
				14
	Total minimum upper division credits			65

A total of 126 credit hours is required to complete the B.S. degree in wood products engineering with the wood products option.

*At least 9 credit hours of elective concentration courses must be selected from an advisor-approved sequence of technical courses. Examples of acceptable courses include the following:

Marketing/Production Management
ACC 204 Financial Account Systems, FIN 355 Money and Banking, FIN 356 Corporation Finance, MAR 355 Marketing and Society, LPP 255 Introduction to the Legal System, O&M 346 Organizational Behavior, TDM 365 Transportation and Distribution Management, MAR 457 International Marketing Management, WPE 343 Construction Estimating, OPM 365 Management of Operations, OPM 464 Manufacturing Management System, OPM 465 Control of Operations. OPM 466 Operations Management and Systems Analysis, O&M 447 Management Policy

Wood Science
PHY 212 Physics II, CHE 116 Chemistry II, FCH 221 Organic Chemistry, FCH 571 Wood Chemistry, EFB 541 Wood Microbiology, ERE 496 Tropical Timbers

facturing and utilization, or to conduct the research and development required for new products, processes, and treatments. Job titles of recent graduates include:

- Applications Engineer
- Product Development Engineer
- Wood Products Technologist

Graduate Opportunities

Through the program in environmental and resource engineering, the Faculty of Wood Products Engineering participates in graduate education leading to the master of science and doctor of philosophy degrees.

The objective of the graduate program is to provide students with an understanding of the behavior of wood and composite materials made from wood. Areas of research are described in the section on Division of Engineering (p. 57). Students with backgrounds in such varied fields as wood technology, engineering, or biology can pursue graduate study in this field.

Research in progress in ultrastructure includes light and video microscopy of wood fracture to elucidate wood fracture mechanisms, strain field analysis of wood and paper, cellulose synthesis and the cytoskeleton, and intracellular communication (plasmadesmata, gap junctions). Current projects in the field of mechanics are focused on the dynamic and static response of wood and wood structures to various load conditions, and comparison of the duration of load of juvenile and mature wood. Other active research areas include wood biodegradation and preservation, expert systems relating wood properties to wood utilization, radio-frequency and dehumidification seasoning of wood, and tree growth-wood quality relations.

Laboratory facilities include a mechanical testing laboratory with a wide range of testing machines, electronic data acquisition facilities, shaker table and frequency analyzers, and complete wood processing facilities including a sawmill, plywood mill, dry kiln, and wood preservation equipment. One of the largest wood collections in the world (the H. P. Brown Memorial Wood Collection) is used to support the graduate research program of the Tropical Timber Information Center.

A complete microscopy laboratory is provided by the N. C. Brown Center for Ultrastructure Studies. This equipment includes transmission electron microscopes, scanning electron microscopes with energy dispersive x-ray analysis and particulate analysis accessories, and a wide variety of light microscopes equipped with image enhancement and various video image analysis capabilities. Graduate students using this equipment have superlative tools to relate macroscopic behavior of wood to its anatomical characteristics.

Course Offerings

COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY COURSE DESCRIPTIONS

The courses offered by the College are grouped by general subject areas, and the number of credit hours appears after the course title. A credit hour means one recitation (or lecture) hour per week. Three laboratory hours are equivalent to one lecture hour.

The semester(s) after each course indicates when it is normally offered. The College reserves the right to alter the scheduled offering of a course when its enrollment is too small, or when there is no qualified faculty member available to teach it.

Courses listed in this catalog are subject to change through normal academic channels. New courses, course deletions, and changes in courses are initiated by the cognizant Faculties or programs, approved by the appropriate academic dean, faculty committee, and the college faculty.

Course Numbering System

Code Levels:

100-499 Undergraduate courses for which no graduate credit may be given.

500-599 Graduate courses designed expressly for areas of specialization in post-baccalaureate programs or in the professional program leading to the Bachelor of Landscape Architecture. Qualified undergraduate students may enroll by permission of the instructor.

600-699 Graduate courses designed expressly for advanced levels of specialization. Undergraduate students with a cumulative grade point average of 3.000 or better may enroll in these courses with an approved petition.

700-999 Advanced graduate level courses for which no undergraduate students may register.
Shared resources courses, designated as 400/500 or 400/600, are designed when the topic coverage of both courses is the same. Separate course syllabuses are developed expressly differentiating the requirements and evaluative criteria between the undergraduate course and the graduate course.

General Subject Areas

APM—APPLIED MATHEMATICS

APM 153. Computing Methods for Engineers and Physical Scientists .... (3)
Introduction to programming structures: flowcharts, language statements, and subprograms. Introduction to data structures: arrays, scalars, and others. Introduction to data codes: numbers and characters, "natural" and binary. Introduction to algorithms at the procedural level.

APM 155. Computing Methods for Foresters and Biologists (3)
Introduction to computing resources: mainframe and personal computers. Introduction to computing: computing mechanisms, data representations, and sources of computation error. Introduction to applications computing: word processing, spreadsheets, communications/electronic mail, computer graphics, and geographic information systems.

APM 355. Computer Applications .... (3)
Introduction to computing resources: mainframe and personal computers. Techniques of structured problem-solving. Introduction to computing: computing and computer network terminology. Introduction to applications computing: word processing, spreadsheets, communications/electronic mail, and computer graphics.

APM 360. Introduction to Computer Programming .... (3)
The basic course in computer programming offered by the College. It is intended to provide the student with the skill and understanding needed to utilize digital computer languages for problem solving. Thecourse will cover instruction in Fortran and an introduction to APL; cursory use of operating systems; and some background material in general hardware/software designs. Fall and Spring.

APM 391. Introduction to Probability and Statistics .... (3)
Elementary probability including permutations, combinations, and other counting formulae, and basic statistical inference, including point estimation, confidence intervals, and hypothesis testing for one or two population means or proportions.

APM 395. Probability and Statistics for Engineers .... (3)
Elementary probability including permutations, combinations, and other counting formulae, and basic statistical inference, including point estimation, confidence intervals, and hypothesis testing for one or two population means or proportions.
Prerequisite: Calculus through integral calculus.

APM 492. Forest Biometrics .... (3)
Two hours of lecture, three hours of laboratory. Analysis of variance including nested and cross-classification. Matrix approach to multiple linear regression and weighted least squares. Nonlinear regression. Sampling methods and design. Applications to forestry problems. Fall.
Prerequisite: APM 391 or equivalent.

APM 500. Introduction to Computer Programming for Graduate Students .... (3)
A basic course in computer usage. Provides the skill needed to utilize digital computer languages for problem solving. Includes a study of Fortran with a discussion of APL and Assembly Language. Other topics include representation of information, management of files, error control, operational systems and job control.

APM 510. Statistical Analysis .... (3)
Two hours of lecture and three hours of laboratory. A treatment ofstatistical inference, including paired design, group design, linear regression and correlation, one way analysis of variance and some applications of chi-square. Calcula-

tion of statistics, test of hypotheses and proper interpretation of calculated statistics. Fall.

APM 620. Analysis of Variance .... (3)
Three hours of lecture and recitation and three hours of laboratory. Multiway classifications in the analysis of variance, with emphasis on the development of models, including randomized blocks, latin squares, split plots, and factorial designs with fixed effects, random effects, and mixed effects; multiple and partial regression and correlation (including curvilinear), using matrix methods; analysis of covariance. Fall.
Prerequisites: Graduate standing and an introductory course in statistics covering material through the one-way analysis of variance.

APM 625. Introduction to Sampling Techniques .... (3)
Two hours of lecture and three hours of laboratory. Introduction to the scientific basis of sampling: selecting an appropriate sampling unit; choosing an efficient design; calculating sampling error; determining a sample size to meet stated objectives. Fall.
Prerequisite: APM 391 or equivalent.

APM 630. Regression Techniques with Applications to Forestry .... (3)
Two one and one-half hours of lecture. Review of matrix algebra, probability theory and statistical methods. Basic concepts in regression analysis. Classical linear regression model. Least and weighted least squares method. Dummy variables and their uses in regression and covariance analysis. Applications to problems of statistical prediction and estimation from the field of forestry in general and forest mensuration and inventory in particular. Fall.
Prerequisite: APM 391 or equivalent.

APM 635. Multivariate Statistical Methods .... (3)
Estimation and inference for the multivariate normal distribution. Multivariate analysis of variances, factor analysis, principal components analysis, canonical correlation, discriminate analysis, cluster analysis. Spring.
Prerequisite: One semester of statistics.

APM 640. Mathematical Modeling of Environmental Systems .... (3)
Three hours lecture/discussion. This course provides students with skills to develop and apply mathematical models of environmental fate processes, perform analyses of sensitivity and uncertainty to facilitate model selection, parameter estimation, and experimental design, and assess the role of mathematical modeling in relation to other aspects of environmental systems analysis and management. Fall.
Prerequisites: Calculus through integral calculus, introductory probability and statistics, introductory differential equations, and knowledge of a programming language.

APM 650. Operations Research .... (3)
Two one and one-half hours of lectures. Deterministic and Stochastic Operations Research models applicable to managerial problems. Linear programming, transportation and allocation models, goal programming, dynamic programming, network analysis, and simulation techniques. Spring.
Prerequisites: APM 391 and MAT 227 or equivalent, or permission of the instructor.

APM 696. Special Topics in Quantitative Methods .... (1-3)
Experimental and developmental courses in areas of quantitative methods not covered in regularly scheduled courses. A course syllabus will be available to students and faculty advisors prior to registration.

CMN—COMMUNICATIONS (LANDSCAPE ARCHITECTURE)

(See also courses listed below under EIN and LSA.)

CMN 380. Technical Drawing I .... (1)
One three-hour drafting room period. Elements of perspective, isometric, oblique, and orthographic projection. Practice in freehand and instrument drawing. Fall.

CMN 382. Graphic Communication .... (3)
Two three-hour studios and one one-hour lecture per week. Studio time devoted to demonstrations, exercises, and projects. Focusing on sketching, drafting, drawing construction and rendering techniques used in the landscape architecture field. Emphasis on skill development, and use of graphics in the design process. Drawings, examinations, and actual project constitute basis for grades. Fall.

CMN 410. Writing for Environmental Professionals .... (3)
Three hours of lecture and discussion. Principles and practice of writing skills required of environmental professionals. Develop proficiency in determining the purpose of a document; analyzing the audience; selecting, developing, and organizing the information in an appropriate design; and writing clearly, precisely, and effectively. Writing assignments are made weekly; rewriting is routinely required. Fall and spring.
Prerequisite: Satisfactory completion of a college-level course in basic writing skills.

CMN 531. Environmental Communications .... (3)
Three hours of lecture/discussion. An introductory course for seniors and graduate students which presents techniques and processes in education and communications applicable in environmental science, management, planning, and design. Topics incude basic teaching, learning and communications theory and strategy, working with the press, electronic media, gaming and simulation, public address techniques, slide/tape production and use, film production and use. Spring.

CMN 552. Graphic Communication .... (3)
Two three-hour studios and one one-hour lecture per week. Studio time devoted to demonstrations, exercises and projects focusing on sketching, drafting, drawing construction and rendering techniques used in the landscape architecture field. Introduction to drawing reproduction and technologies. Emphasis on skill development, use of graphics in the design process. Drawings, examinations, and a final project constitute basis for grades. Fall.
Prerequisite: M.L.A. status or permission of the instructor.

CMN 738. Environmental Education Programs of.. Agencies and Institution .... (1-3)
One three-hour seminar session. An analysis of contemporary environmental education objectives, methodologies, and philosophies employed by various public and private institutions. Attendance, readings, and short paper required for one-hour credit. For two or three hours credit, an individual investigation of the environmental education and communications activity of an agency or organization is also required. Fall.

EFB—ENVIRONMENTAL AND FOREST BIOLOGY

The Faculty of Environmental and Forest Biology offers a diverse array of courses at both undergraduate and graduate levels. Based onstudent interest, curricula can be designed to accommodate a degree of specialization in one or more subdisciplines of biology. In the following list, courses numbered from ( )00 - ( )25 (at each level) are General Biology offerings; those from ( )26 - ( )50 are Plant Sciences, and those from ( )51 - ( )95 are Animal Science courses.

NOTE: All EFB courses of 300 level and above require a minimum prerequisite of one year of college biology or equivalent. A course at an appropriate level may be taken with permission of the instructor.

EFB 220. Global Environment .... (3)
A survey of current global environmental change, including global warming, acidic deposition, the ozone hole, El Niño, loss of biodiversity, and energy and population problems. Socio-economic and political ramifications of global change. Three lectures per week. Spring.
Prerequisites: None.

EFB 226. General Botany .... (4)
Three hours of lecture and three-hour laboratory. An introduction to plant biology with special emphasis on the structure and function of the green plant Fall.

EFB 285. Principles of Zoology .... (4)
An introduction to the study of vertebrate and invertebrate animals, including reproduction, development, heredity, physiology, form and function, diversity, evolution, and behavior. An integrated laboratory and lecture course that introduces processes of scientific inquiry and provides a basis for understanding the natural world. The course provides the fundamental background for advanced or specialized courses, e.g., in animal physiology, anatomy, taxonomy, ecology, behavior, and fisheries/wildlife sciences.

EFB 303. Introductory Environmental Microbiology .... (4)
Three hours of lecture and three hours of laboratory. An introduction to the biology of microorganisms and viruses and a study of their interactions with other microbes and macroorganisms. Fall.

EFB 307. Principles of Genetics .... (3)
Three hours of lecture and discussion. A general course covering concepts of genetics and evolution basic to upper division biology and biochemistry courses. Includes the inheritance and analysis of Mendelian and quantitative traits, the chemical nature of the gene and its action, genetic engineering, the genetic structure of populations and their evolution. Numerical methods for the characterizing and analyzing genetic data are introduced. Spring.
Prerequisite: A one-year college introductory biology course.

EFB 308. Principles of Genetics Laboratory ...(1)
Three hours of auto-tutorial laboratory. Experiments with plant and animals and computer simulation exercises demonstrate the basic principles of inheritance of Mendelian traits and changes in populations caused by major forces in evolution or by breeding procedures. Numerical methods for characterizing quantitative traits and for testing hypotheses are introduced. Spring.
Corequisite: EFB 307 or equivalent.

EFB 309. Introduction to Quantitative and Population Genetics .... (1)
Lectures and auto-tutorial laboratories the latter half of the semester of EFB 307 and 308. Basic genetic concepts of quantitative inheritance, the structure of populations, and evolution. Laboratory experiments and computer simulations are used to demonstrate these concepts. Numerical methods for characterizing and analyzing genetic data are introduced. Not open to students taking EFB 307 and 308. Spring.
Prerequisite: An introductory genetics lecture-laboratory course deficient in these areas of genetics and permission of the instructor.

EFB 320. General Ecology .... (3)
Two hours of lecture, three hours of field trips during the first half of the semester. Introduction to ecosystem ecology stressing the dynamic interrelationships of plant and animal communities with their environments ecological factors, energy flow and trophic levels in natural communities, plant responses and animal behavior, population dynamics, biogeography, and representative ecosystems. The ecological impact of man is reviewed. Fall.

EFB 325. Cell Physiology .... (3)
Three hours of lecture. Introduction to the dynamics of living systems with emphasis on the universality of the biological world. Fall.
Prerequisite: One semester of organic chemistry.

EFB 326. Diversity of Plants .... (3)
Two hours of lecture and one three-hour laboratory. An evolutionary survey of plants from unicellular prokaryotes to multicellular eukaryotes. Coverage includes the algae, fungi, bryophytes, lower vascular plants, ferns, gymnosperms and angiosperms. Spring.
Prerequisites: EFB 226 or general biology.

EFB 335. Dendrology .... (2)
One hour of lecture and one three-hour laboratory/field trip. Field study, identification, and major characteristics of important forest trees of North America. Open only to students in the Forest Engineering curriculum. Fall.

EFB 336. Dendrology .... (3)
Two hours of lecture and one three-hour laboratory/field trip. Field study, identification, natural history, and elementary silvics of important forest trees of North America. Fall.

EFB 340. Forest and Shade Tree Pathology .... (3)
Two hours of lecture and three hours of autotutorial laboratory. Major diseases of forest, shade, and ornamental trees and deterioration of forest products, with emphasis on disease identification, principles of disease development, effects of disease on the host, and practical control measures. Spring.

EFB 351. Principles of Forest Entomology .... (3)
Two hours of lecture, three hours of laboratory. Elements of insect classification, morphology and physiology; introduction to the role of insects in forested ecosystems; insect surveys, hazard rating, impact, control and other aspects of applied forest pest management. Designed for students in Resources Management. Spring.

EFB 352. Elements of Entomology .... (3)
Two hours of lecture, three hours of laboratory/field work. General classification of insects, morphology, physiology, ecology, behavior, and basic principles of population control. Emphasis through illustration is on the role of insects in the forest environment. Fall.

EFB 355. Invertebrate Zoology .... (4)
Three hours of lecture, three hours of laboratory. Structure, function, classification, and evolution of invertebrates. Emphasis on functional biology and ecological interactions. Fall.

EFB 382. Wildlife Conservation .... (3)
Two hours of lecture, one hour of recitation. Introduction to the biological principles of conservation including the relationship of natural resources to modern society. The wildlife resource and its conservation will be emphasized. It is not designed for students concentrating in the area of Forest Wildlife Management. Fall.

EFB 385. Comparative Vertebrate Anatomy .... (4)
Three hours of lecture and three hours of laboratory per week. Analysis of vertebrate structure, with emphasis on comparative study of organ systems. Includes evolution of form and function, major adaptive patterns, and phylogenetic relationships in vertebrates. Spring.

EFB 405. History of the Natural Sciences/Contemporary Issues .... (2)
Two hours of lecture. A review of the history of western science from pre-Ionian to Darwin, with evaluation of the impact of cultures and theology on the progress of scientific thought. Contemporary issues concerning bioethics and biotechnology

will be examined for their influence on the scientific community and social structure. Spring.

EFB 410. Concepts in Evolution and Biological Systematics (3)
Three hours of lecture. Exploration of the core concepts of evolutionary and systematic biology to better understand organic diversity. Includes study of evolution's causal factors (mutation, migration. drift, and natural selection) and results (microevolution, differentiation, speciation and macroevolution) as well as the principles that allow classification of living organisms and reconstruction of evolutionary histories. Examples are drawn from plants, animals, and microorganisms. Spring.
Prerequisitie: Genetics.

EFB 412. Introduction to Chemical Ecology.....(3)
Three hours of lecture with discussion. Centers on chemical signals among organisms from microbes to man as they affect ecology, physiology and behavior and as they can be utilized for agriculture, pest management, and animal husbandry.
Prerequisites: Biology (one year), organic chemistry (one year).
Note: Also listed as FCH 440.

EFB 415. Ecological Biogeochemistry........................(3)
Three hours of lecture and discussion. Investigation of the principles of biogeochemistry in ecosystems. The transformations and fluxes of elements in terrestrial and aquatic ecosystems including global cycles are emphasized. Fall.
Prerequisites: Courses in general ecology and introductory chemistry.

EFB 420. Field Experience Internship ....(5)
Full-time for at least five weeks, or equivalent, of employment withan agency or professional involved in field activity. A resident faculty member is required to serve as course evaluator. Approval of curriculum director is necessary. See advisor for detailed procedural information. Summer.

EFB 421. Ecology of Freshwaters ....(2.5)
Half-time for four weeks. Cranberry Lake Biological Station. Experimental and observational studies of environmental and biotic interactions influencing productivity of freshwaters. Basic concepts at the organismic, population, and community level. Summer, Cranberry Lake Biological Station.

EFB 426. Plant Propagation ....(1)
One combined lecture-demonstration laboratory plus supervised greenhouse assignments. Instruction in principles and practices of plant propagation and in related greenhouse operations. Fall and Spring.
Prerequisite: Senior status in Environmental and Forest Biology curriculum.
Note: Cannot be used to satisfy the 6-hour biology curriculum requirement in the plant sciences.

EFB 435. Adirondack Flora .... (2.5)
Field study of summer flora of the Adirondacks including field identification and ecology of key species. Summer, Cranberry Lake Biological Station.

EFB 436. Dendrology II ....(1)
One three-hour field trip/laboratory. A continuation of Dendrology I emphasizing trees and shrubs ecologically important in the Central New York region and economically important in North America. Fall.

EFB 440. Mycology ....(3)
Two hours of lecture, three hours of laboratory. Fundamentals of the morphology, taxonomy, life histories, ecology and symbiotic relationships of fungi.

EFB 441. Field Plant Pathology ....(2.5)
Field study of plant diseases and decline with special emphasis on the field identification of different pathogens, including viruses, bacteria, fungi, insects, and pathogenic plants. Summer, Cranberry Lake Biological Station.

EFB 442. Field Mycology ....(2.5)
An introduction to the collection and identification of Adirondack fungi. Field techniques and laboratory identification of the major fungi found in selected ecosystems. Summer, Cranberry Lake Biological Station.

EFB 443. Plant Virology......................................(3)
Two hours of lecture and three hours of laboratory. History of plant virology, identification and characterization of plant viruses, including transmission mechanisms, vector relationships, purification, and serology. Laboratory will present techniques for the identification and characterization of plant viruses. Spring (even years).
Prerequisite: EFB 303, equivalent, or consent of the instructor.

EFB 445. Plant Ecology ....(3)
Two hours of lecture and discussion and one laboratory session. A first course in plant community ecology dealing with the dynamics of community development and change and the process of community analysis and description. Spring.
Prerequisite: EFB 320.

EFB 448. Physiological Ecology of Plants ....(3)
Three hours of lecture. Examination of the interactions between plants and their environment. Emphasis will be given to the physiology of plants as it is modified by fluctuating external conditions and the mechanisms of plant adaptation. Students completing EFB 448 should not enroll in EFB 330. Fall.
Prerequisites: An introductory course in physics, EFB 320 and EFB 326.

EFB 451. Pest Management Theory and Practice ....(2)
Two hours of lecture for nine weeks; then one lecture hour and one three-hour laboratory for four weeks. A review of history and govern-ental policy for four weeks. A review of history and governmental policy of pest management, as well as basic instruction in theory and practicum.
Prerequisite: EFB 352 or equivalent.

EFB 452. Principles of Chemical Control ....(3)
Two hours of lecture; one three-hour laboratory. A study of the chemistry, toxicology, handling and application of chemicals used to manage pest populations. A primer for the State Pesticide Application examinations. Spring.
Prerequisite: EFB 451.

EFB 453. Forest and Aquatic Insects ....(2.5)
The forest and aquatic insects of Cranberry Lake Region and their role in these environments and habitats. Insect collection required. Summer, Cranberry Lake Biological Station.

EFB 454. Wood Deterioration by Insects ....(3)
Three hours of lecture, discussion, and demonstration. Biology, identification, ecology of insect and wood interrelations; prevention of injury and control of insects injurious to forest products and wood in use. Spring.
Prerequisite: EFB 352 or equivalent.

EFB 476. Vertebrate Ecology ....(2.5)
Utilization of unique Adirondack forms and communities to study population dynamics, behavior, systematics, and the ecological role of vertebrates; standard field and laboratory techniques. Summer, Cranberry Lake Biological Station.

EFB 478. Microcommunity Ecology ....(2.5)
Field study of terrestrial invertebrate microcommunities; descriptive and comparative assay of microhabitats incorporating experimental and field techniques. Summer, Cranberry Lake Biological Station.

EFB 479. Field Ornithology........................(2.5)
Field study of the ecology, distribution, and behavior of birds in the Adirondack region. Techniques used in conducting field

studies in avian biology will be emphasized (including mist netting, banding, field identification, and avian censusing). Summer, Cranberry Lake Biological Station.

EFB 480. Principles of Animal Behavior .... (4)
Three hours of lecture, one hour of recitation per week. A study of the basic principles of animal behavior, stressing exogenous and endogenous mechanisms of control, with emphasis on the evolution of behavior. Spring.

EFB 481. Behavioral Ecology .... (2.5)
Study of the behavioral adaptations of animals to their environment. Emphasis will be placed on field observation and experimentation. Habitat selection, foraging, mating, and social behavior will be considered. Summer, Cranberry Lake Biological Station.
Prerequisite: EFB 480 Principles of Animal Behavior or equivalent behavior course.

EFB 483. Biology of Birds and Mammals .... (4)
A course surveying the taxonomy, anatomical-behavioral-physiological adaptations and natural history of birds and mammals. Techniques for the field study of a vertebrate species will be discussed. Fall.

EFB 485. Herpetology .... (3)
Two hours of lecture and three hours of laboratory. An introduction to the structure, function, ecology, behavior, development, and distribution of amphibians and reptiles as they relate to the systematics of the various groups. Spring.

EFB 486. Ichthyology .... (3)
Two hours of lecture, three hours of laboratory. An introduction to the anatomy, physiology, ecology, behavior, and taxonomy of fishes. Spring.

EFB 487. Fishery Biology .... (4)
Three hours of lecture and three hours of laboratory. Introduction to models of growth, mortality, production, and exploitation; aspects of fish ecology and behavior related to the dynamics and management of fish populations. Fall.
Prerequisite: EFB 486 or equivalent.

EFB 488. Ecology of Adirondack Fishes ....(2.5)
Study of the ecology of fishes, with detailed individual investigation of the ecology of Adirondack fishes. Summer, Cranberry Lake Biological Station.

EFB 489. Animal Physiology .... (4)
Three hours of lecture and three hours of laboratory per week. An introduction to the fundamentals of animal physiology, including function of the basic organ systems, organismal and physiological adaptation to the environment. Fall.
Prerequisites: General zoology (EFB 285 or equivalent), and either one semester of biochemistry or cell physiology (EFB 325 or equivalent).

EFB 490. Wildlife Ecology and Management .... (3)
Three hours of lecture. A study of the ecological principles governing wild animal populations and their habitats and the relationship of these principles to management programs and decisions. Spring.
Prerequisites: EFB 320 or equivalent.

EFB 491. Wildlife Ecology and Management Practicum ..... (2)
One hour discussion, three hours laboratory. Practical contact and experience with wildlife management techniques and programs; relates practices to principles of management. Designed for biology students wishing to pursue careers as wildlife biologists. Spring.
Corequisite: EFB 490; *Pre- or corequisite:* LIB 300.

EFB 493. Wildlife Habitats and Populations ....(4)
Three hours of lecture/discussion and one three-hour laboratory per week, one Saturday field trip required. Application of ecological concepts including succession and population biology to wildlife management planning and program assessment. Students are exposed to U.S. Fish and Wildlife Service habitat evaluation procedures and fundamentals of population modeling. Fall.
Prerequisite: EFB 490/491, or graduate student standing.

EFB 496. Topics in Environmental and Forest Biology .... (1-3)
Experimental, interdisciplinary, or special coursework in biology for undergraduate students. Subject matter and method of presentation varies from semester to semester. May be repeated for additional credit. Fall or Spring.

EFB 497. Seminar .... (1)
One hour of presentations and discussion. A topic in Environmentaland Forest Biology will be emphasized and its importance to contemporary issues will be addressed. Fall or Spring.
Prerequisite: 90 credit hours.

EFB 498. Research Problems in Environmental and Forest Biology .... (1-3)
Independent research in topics in Forest Biology for the superior undergraduate student. Selection of subject area determined by the student in conference with appropriate faculty member. Tutorial conferences, discussions and critiques scheduled as necessary. Final written report required for departmental record. Fall, Spring, and/or Summer.

EFB 500. Forest Biology Field Trip .... (1-3)
A five- to ten-day trip to (1) agencies engaged in biological research, management, and administration, or (2) regions or areas of unusual biological interest. A final report is required. Estimated student expense, $75. Fall or Spring.

EFB 501. Introduction to Genetic Engineering .... (3)
Three hours of lectures. The concepts and processes of recombinant DNA technology for the manipulation of genomes of plants, animals, fungi, and bacteria to produce new organisms of practical value. Spring.

EFB 505. Microbial Ecology .... (3)
Two hours of lecture and three hours of laboratory. Applied and environmental aspects of microbiology with emphasis on biochemical interactions. Examining microbial processes and interrelationships in aquatic and terrestrial ecosystems. Spring.

EFB 510. Health and Our Chemical Environment .... (3)
Three hours of lecture and discussion. Analysis of our chemical environment and discussion of health hazards of anthropogenic and natural chemicals in environment associated with typical life styles of our society. Emphasis is on basic toxicological principles, scientific basis of regulations and risk assessment for balanced judgment of issues on health hazards of environmental chemicals.

EFB 515. Population Ecology .... (3)
Two hours of lecture and three hours of laboratory. Description, analysis, evolution, interactions and stability of natural and experimental populations. Spring.
Prerequisite: EFB 320 or equivalent.

EFB 516. Ecosystems .... (3)
Ecosystems emphasizes the integration of biological, chemical and physical aspects of the environment applied in an integrative fashion to units of landscape and water. Major topics covered include a survey of ecosystem types, energy flow, nutrient cycles and the relation of ecosystem processes to plant and animal populations. Spring.
Prerequisite: EFB 320 or equivalent.

EFB 518. Systems Ecology .... (4)
Three hours of lecture and three hours of laboratory/field experience. Survey of history, literature, and techniques of systems ecology, including, especially, the teaching of intellectual, basic mathematical, and computer skills that allow the student to take an environmental problem of his orher choosing and simulate it on a computer. Fall.

Prerequisites: One course in ecology. It is also recommended that the student have at least some previous or concurrent experience with computers. Weekend field trip required.

EFB 520. Pest Management Systems in Forestry .... (3)
An in-depth analysis of management systems developed for forest pest problems. This course examines the concepts and processes of integrated pest management systems in forestry. It analyzes the major forest insect and disease systems developed in recent years. Vegetation management and pesticide use in forestry are also covered. A forest management plan is prepared and defended according to preestablished guidelines. The course is required for the Master of Forestry degree and is part of a sequence of Forest Entomology, Pest Management, and Forest Pathology courses offered. Spring.
Prerequisites: EFB 351/352 or basic entomology; or forest pathology.

EFB 522. Ecology, Resources and Development .... (2)
Examines the emerging field of ecological economics by reviewing traditional economic approaches, especially as applied to evaluating nonmarket processes—such as many of the services of nature. Introduces alternative approaches focusing on energy and resources, rather than money, as a basis for wealth and evaluation. Spring.
Prerequisites: A course in ecology and a course in economics.

EFB 523. Tropical Ecology .... (3)
One hour of lecture coupled with a period of intensive field study over spring break on a tropical island in the Caribbean. Principles of tropical ecology, resource management, and island biogeography are presented. Field trips to a variety of tropical ecosystems including: rain forest, coral reefs, crater lakes and montane rain forest. Comparisons with north temperate ecosystems are made. Additional fees required to cover cost of travel and lodging during field portion of course. Requires the ability to swim. Spring.
Prerequisite: EFB 320 or equivalent.

EFB 524. Limnology .... (3)
Three hours of lecture. An introduction to the physics, chemistry, andbiology of inland waters, with particular emphasis on lakes. The course focuses on lakes as integrated ecosystems, and analyzes perturbations in this environment on the structure and function of the biological communities contained therein. Fall.
Prerequisites:: Introductory courses in physics and chemistry, and EFB 320.

EFB 525. Limnology Laboratory .... (1)
One laboratory or field trip. An introduction to limnological techniques and the procedures for empirically analyzing ecological relations in aquatic ecosystems. Field trips to local aquatic habitats. Fall.
Co- or *Prerequisite:* EFB 524.

EFB 526. Introduction to Plant Tissue Culture .... (3)
One hour of lecture and six hours of laboratory designed to introduce students to the scientific and commercial uses of plant tissue culture.
Prerequisite: A semester of General Botany or equivalent.

EFB 529. Ecology of the Soil Plant System ..... (3)
Three hours of lecture and discussion. The course develops the foundations of and understanding in soilplant relationships with emphasis on soil nutrients and trace elements. Role of the nutritional factor in population abundance and distribution, competition, allelopathy, species endemism, community development (succession), and anthropogenic factors are covered.
Prerequisites: EFB 320, or EFB 445, or equivalent.

EFB 530. Plant Physiology .... (3)
Three hours of lecture. Internal processes and conditions in higher plants with emphasis on physiological and biochemical concepts. For students majoring in the biological sciences. Spring.
Prerequisites: EFB 325, EFB 326.

Note: EFB 531 also required for Plant Sciences Concentration students.

EFB 531. Plant Physiology Laboratory .... (2)
Two laboratory sessions. Introduction to methods and procedures of physiological research. Spring.
Prerequisites: Co-requisite EFB 530, or permission of the instructor.

EFB 532. Plant Anatomy .... (3)
Two hours of lecture and three hours of laboratory. An introductory course in plant anatomy designed to familiarize the student with the organization and development of the primary and secondary plant body of higher plants. Spring.
Prerequisite: EFB 326.

EFB 535. Systematic Botany .... (3)
Two hours of lecture and three hours of laboratory. Identification, nomenclature, and classification of flowering plants with special emphasis on local flora and on developing the ability to classify the plants of any region. Fall.
Prerequisites: EFB 326, EFB 327.

EFB 541. Wood Microbiology .... (3)
Two hours of lecture and three hours of laboratory/field trip. Survey of lignicolous microorganisms, their roles in the degradation of wood, and principles of their control. Detailed consideration of all types of decay of wood and its products from chemical, ultrastructural, biotechnological and ecological perspectives. Fall.

EFB 542. Freshwater Wetland Ecosystems .... (3)
Three hours of lecture. An examination of the structure and function of various freshwater wetlands. Ecologic principles that broadly apply to all wetland ecosystems are examined and contrasted with terrestrial systems. The effect of management activities on, and the management potential of, wetlands are also examined.
Prerequisite: EFB 320 or equivalent.

EFB 545. Forest Decline Concepts .... (3)
Three hours of lecture/discussion per week. Environmental stress factors will be integrated into forest decline concept models using specific examples from forest pathology, forest entomology, ecology, resource management and current environmental topics. Fall.

EFB 551. Forest and Shade Tree Entomology .... (2)
Two hours of lecture. Important forest and shade tree insects, detection, evaluation, prevention, and control of their damage; their relation to silviculture and management of forests and shade trees. Spring.
Prerequisite: EFB 352 or equivalent.

EFB 552. Forest and Shade Tree Entomology Laboratory .. (1)
Three hours of laboratory/field trip. Identification of important forest and shade tree insects and their damage. Spring.
Pre- or Corequisite: EFB 551.

EFB 554. Aquatic Entomology .... (3)
An introduction to the identification, life histories, and ecology of aquatic insects, with emphasis on genera found in the northeastern U.S. Includes a consideration of the functional role of insects in aquatic systems, and current avenues of research. Intended for seniors and graduate students pursuing interests in entomology, fisheries and wildlife, forestry, limnology and general ecology. Fall.
Prerequisite: One course in entomology or permission of the instructor.

EFB 555. Chemical Ecology of Vertebrates .... (3)
A survey of chemical interactions within and among species of fish, amphibia, reptiles, birds and mammals, including humans. Signal production, sensory processes, plant-animal interactions, practical applications of chemical ecology, and effects of global and local change on chemical ecology processes. Spring.

Prerequisites: One semester of Organic Chemistry and at least two of the following: General ecology, animal behavior, introduction to chemical ecology, and a course in vertebrate biology.

EFB 560. Environmental Toxicology of Insecticides (3)
Two hours of lecture. Basis of action of insecticides in living systems, behavior of insecticides and microtoxicants in environment, interaction of insecticides and biological systems. Fall.
Prerequisite: EFB 325 or equivalent course in physiology or biochemistry.

EFB 561. Medical Entomology .... (3)
Three hours of lecture and recitation. Study of arthropods affecting man, domestic animals, and wildlife with emphasis on their biology, control,and relationships to vertebrate disease. Spring (even years).
Prerequisite: EFB 352 or equivalent.

EFB 565. Insect Morphology .... (3)
Two hours of lecture and three hours of laboratory. A comparative study of the external morphology of insects emphasizing evolutionary trends, especially modifications of homologous structures. Topics of special importance include intersegmental relationships, feeding, sensory mechanisms, locomotion, and reproduction. Spring.
Prerequisite: EFB 352.

EFB 570. Insect Physiology .... (3)
Two hours of lecture and three hours of laboratory. Study of the life processes in insects; introduction to modern physiological instrumentation and laboratory methods. Spring.
Prerequisite: EFB 325.

EFB 578. Terrestrial Community Ecology .... (3)
Three hours of lecture. Relation of terrestrial vertebrates and invertebrates to their physical, chemical, and biological environment. Emphasis on community principles, structural quantification, and evolutionary processes of terrestrial animals. Fall.
Prerequisite: EFB 320 or equivalent.

EFB 580. Wetland Wildlife Ecology and Management .... (3)
An assessment of important wildlife resources associated management within coastal and freshwater wetlands in North America. The course also covers state and federal wetland classification schemes, regulations, policy, and specific topics in wetland wildlife management.

EFB 590. Wilderness Wildlife Management .... (2.5)
The ecology, philosophy, and politics of wilderness wildlife management, including wilderness ecosystems, some field characteristics of Adirondack wilderness, and management of selected wilderness species.
Prerequisite: EFB 490, or equivalent introductory course in wildlife management.

EFB 601. Molecular Biology Techniques .... (3)
One hour of lecture and six hours of laboratory. Techniques used in molecular biology research are presented, including the extraction measurement, analysis, and manipulation of nuclear and organellar DNAs of plants and fungi. Some methods on RNA and proteins will be covered. Fall.
Prerequisites: FCH 530, 531, and 532.

EFB 602. Genetic Engineering of Eucaryotes .... (3)
Three hours of lecture. Genetic engineering of eucaryotic organisms with emphasis on plant and fungal systems. Principles and current research will be covered.
Prerequisites: EFB 407, FCH 530, and 532, or equivalent.

EFB 607. Breeding Plants for Resistance to Disease and Pests .... (2)
Two hours of lecture and discussion. Principles, methods, and strategies in breeding for resistance to diseases and pests. The effectiveness, durability, and limitations of resistance breeding in pest management and control are considered.
Prerequisites: Introductory courses in genetics or forest tree improvement and in forest pathology or entomology, or permission of the instructor.

EFB 610. Ecological Biogeochemistry .... (3)
Three hours of lecture and discussion. Investigation of the principles of biogeochemistry in ecosystems. The transformations and fluxes of elements in terrestrial and aquatic ecosystems including global cycles are emphasized. Fall.
Prerequisites: Courses in general ecology and introductory chemistry.

EFB 612. Introduction to Chemical Ecology .... (3)
Three hours of lecture with discussion. Centers on chemical signals among organisms from microbes to man as they affect ecology, physiology,and behavior and as they can be utilized for agriculture, pest management, and animal husbandry. This course is a companion to EFB 412/FCH 440.

EFB 625. Membranes and Biological Transport .... (3)
Two hours of lecture and one hour of discussion. Composition, structure, and physical properties of membranes. Membrane functions including transport, bioelectricity, and cell compartmentalization. Specific transport processes in biological systems. Fall (even years).
Prerequisites: One semester of biochemistry and an advanced physiology course.

EFB 630. Fungus Physiology .... (3)
Two hours of lecture and one hour of discussion. Principles of growth, reproduction, and differentiation of the fungi emphasizing the role of the environment in controlling fungal processes. Spring (even years).
Prerequisite: Two semesters of physiology or biochemistry.

EFB 632. Plant Growth Regulation .... (3)
Three hours of lecture/discussion on topics concerned with the biochemistry and physiology of plant hormones and synthetic growth regulators. Fall
Prerequisite: A course in plant physology or biochemistry.

EFB 633. Chemical Defenses of Plants .... (3)
Three hours of lecture/discussion about the ways in which plants defend themselves chemically against microorganisms, insects, herbivores,and other plants. Fall.
Prerequisite: A course in physiology or biochemistry.

EFB 635. Topics in Plant Nutrition .... (2)
Two hours of lecture, discussion, and seminars. Advanced course dealing with selected topics of mineral and organic nutrition of plants. Fall (odd years).
Prerequisites: Completion of one or more physiologically-oriented plant science courses.

EFB 640. Mycology .... (3)
Two hours of lecture, three hours of laboratory. Fundamentals of the morphology, taxonomy, life histories, ecology, and symbiotic relationships of fungi.
Corequisite: EFB 644.

EFB 641. Phytopathology .... (3)
Two hours of lecture and discussion and three hours of autotutorial laboratory. Principles and concepts of plant pathology. Major diseases of ornamental plants, vegetable crops, fruit crops, field crops, and trees. This is an introductory plant pathology course for graduate students in all departments. Spring.

EFB 642. Epidemiology and Management of Tree Disease .... (3)
Three hours of lecture and discussion, with occasional laboratory or field trip. Brief history of phytopathology, study of epidemiological principles and their application in tree disease management. Survey of disease management strategies in

various regions of the U.S. Spring (odd years).
Prerequisite: EFB 340.

EFB 643. Plant Virology .... (3)
Two hours of lecture and three hours of laboratory. History of plant virology, identification, and characterization of plant viruses, including transmission mechanisms, vector relationships, purification, and serology. Laboratory will present techniques for the identification and characterization of plant viruses. Spring (even years).
Prerequisite: EFB 303, equivalent, or consent of the instructor.

EFB 645. Plant Ecology .... (3)
Two hours of lecture and discussion and one laboratory/discussion. A first course in plant community ecology for beginning graduate students focusing on dynamics of community development and change and the processes of community analysis and
Prerequisite: EFB 320 or equivalent.

EFB 650. Recombinant DNA Technology for Plants and Fungi .... (3)
Three hours of lecture and discussions. An advanced course in molecular biology with emphasis on plant and fungal systems. This course is for students interested in careers in biotechnology as well as for students in other areas who are interested in understanding the genetically altered organisms targeted for release into the environment. Fall.
Prerequisite: An introduction to molecular biology.

EFB 651. General Insect Taxonomy .... (3)
Two hours of lecture and three hours of laboratory. Identification and classification of the important orders and families of insects; acquaintance with pertinent taxonomic literature and use of keys; and understanding of evolutionary principles and concepts and a knowledge of systematic theory and practice. Insect collection required. (Alternative odd years.)
Prerequisite: EFB 565.

EFB 678. Practicum in Terrestrial Community Ecology ..... (3)
One hour of lecture, one hour TBS, and three hours of laboratory. Intensive practical application of ecological principles to the study of terrestrial animal communities. Includes experimental and field collection of data, quantifications, synthesis, and final reporting. Fall.
Pre- or Corequisite: EFB 578 or equivalent.

EFB 680. Behavioral and Physiological Ecology .... (3)
Two hours of lecture and one hour of discussion. An examination ofthe concepts of animal adaptations to ecological change from a behavioral point of view. Particular emphasis will be placed on the role the environment plays in shaping the behavior of a given species. Behavioral and physiological responses to environmental conditions will be treated as a continuum. Spring (odd years).
Prerequisites: One course in ecology, behavior, and physiology.

EFB 682. Invertebrate Symbiosis .... (3)
Two hours of lecture and one three-hour laboratory. An introduction to the ecology and evolution of interspecific relationships of invertebrates. Spring (even years).
Prerequisites: EFB 320, EFB 482.

EFB 689. Animal Physiological Ecology .... (3)
Three hours of lecture per week. A detailed and critical examination of principles and current dogmas in physiological ecology. Topics to be covered: The physical environment and physiological adaptation; the biology of body size; physiologically optimizing use of energy and materials. Spring (alternate even years).
Prerequisites: EFB 489 (or equivalent) or permission of the instructor.

EFB 692. Ecology and Management of Waterfowl .... (3)
A detailed examination of waterfowl ecology and management. The course is structured around the annual cycle, focusing on strategies of survival and reproduction; management aspects are treated throughout the course. Fall.

EFB 693. Wildlife Habitats and Populations .... (4)
Three hours of lecture/discussion and one three-hour laboratory per week, one Saturdaty field trip required. Application of ecological concepts including succession and population biology to wildlife management planning and program assessment. Students are exposed to U.S. Fish and Wildlife Service habitat evaluation procedures and fundamentals of population modeling. Fall.
Prerequisite: EFB 490/491, or graduate student standing.

EFB 695. Urban Wildlife .... (2)
Three hours of lecture and discussion with field trips. A study of the occurrence, adaptations, and values of wildlife in urbanized areas, with emphasis on current research and agency programs. Spring (even years).

EFB 702. Topics in Biotechnology .... (1-3)
Hours to be arranged. Group study covering current topics in biotechnology. Fall or Spring.
Prerequisite: Permission of the instructor.

EFB 720. Topics in Soil Invertebrate Ecology .... (3)
Two one-hour lecture and discussion periods and a three-hour laboratory. Study of literature relating to soil invertebrate microcommunities; taxonomy, culturing, and collection methods of soil fauna; student will conduct an individual research problem. Spring (odd years).

EFB 724. Seminar in Aquatic Ecology .... (1)
Two hours of lecture and discussion. A seminar to explore in some depth areas of current research in aquatic ecology. Fall (even years).
Prerequisite: Six credits in aquatic ecology.

EFB 733. Techniques in Plant Physiology .... (2-4)
Comprehensive study of techniques essential for research in plant physiology. Students may choose the instructors they wish to work with, and should consult the instructors for further details. May be repeated for credit in different specialties. Fall and Spring.
Prerequisites: EFB 531 or equivalent, biochemistry with laboratory.

EFB 740. Mycorrhizae .... (3)
Two hours of lecture and three hours of laboratory/discussion. A basic background course covering structural, functional, and ecological aspects of mycorrhizae; their methods of field and laboratory study; and applications in forestry practice. Fall (odd years).

EFB 741. Topics in Phytopathology .... (3)
Two two-hour lectures and discussions. Discussions of specific subject in phytopathology and wood microbiology. Topic selection is based on availability of expertise and will be announced in advance. This course may be repeated for credit in different specialties. Fall or Spring.

EFB 745. Topics in Plant Ecology .... (2)
Two hours of seminar and discussion. An advanced course dealing with current research in plant community dynamics. May be repeated for additional credit. Fall.
Prerequisite: EFB 445 or EFB 645.

EFB 796. Topics in Environmental and Forest Biology .... (1-3)
Special instruction, conference, advanced study, and research in selected subject areas. Typewritten report required. Check Schedule of Courses for details. Fall and Spring.

EFB 797. Seminar in Environmental and Forest Biology .... (1)
Seminar discussions of subjects of interest and importance in environmental and forest biology. Seminar offerings are available in most subdisciplinary areas. Check Schedule of Courses for details. Fall and Spring.

EFB 798. Research Problems in Environmental and Forest Biology ......(Credit hours to be arranged)
Individual advanced study of selected special problems in environmental and forest biology. Offered by arrangement with individual faculty. Typewritten report required. Fall and Spring.

EFB 830. Physiology of Growth and Development ....(2)
Lecture. A study of the growth and development of plants and the physiological and biochemical processes that influence the development of form and structure in higher plants. Fall (even years).
Prerequisites: EFB 530, EFB 532, and organic chemistry.

EFB 840. Advanced Mycology, Homobasidiomycetes ....(3)
Review of selected literature as well as laboratory training in identification and research techniques. Fall.
Prerequisite: EFB 540.

EFB 841. Advanced Mycology, Heterobasidiomycetes ......(3)
Review of selected literature as well as laboratory training in identification and research techniques. Spring (even years).
Prerequisite: EFB 540.

EFB 842. Advanced Mycology, Ascomycetes ....(3)
Review of selected literature as well as laboratory training in identification and research techniques. Spring (odd years).
Prerequisite: EFB 540.

EFB 843. Advanced Mycology, Deuteromycetes ....(3)
Review of selected literature as well as laboratory training in identification and research techniques. Fall (even years).
Prerequisite: EFB 540.

EFB 851. Advanced Insect Taxonomy ....(3)
Two hours of lecture and three hours of laboratory. Methods, procedures, and concepts of systematics. Examples and material will be drawn from among important groups of forest insects. Fall.
Prerequisite: EFB 651.

EFB 898. Professional Experience ....(1-12)
Professional experience which applies, enriches, and/or complements formal coursework. Graded on an "S/U" basis. Fall, Spring, and Summer.

EFB 899. Master's Thesis or Project Research ....(1-12)
Investigation leading to the completion of a research-oriented thesis or to an application-oriented project. Graded on an "S/U" basis. Fall, Spring, and Summer.

EFB 980. Topics in Animal Behavior ....(2)
Two hours of lecture and discussion. A seminar-type course designed to explore in depth selected and controversial subject areas in animal behavior. Fall or Spring.

EFB 999. Doctoral Thesis Research ....(1-12)
Investigation leading to the completion of the doctoral thesis. Graded on an "S/U" basis. Fall, Spring, and Summer.

EIN—ENVIRONMENTAL INFLUENCES (LANDSCAPE ARCHITECTURE)

(See also courses listed under CMN and LSA.)

EIN 371. American Landscape History ....(3)
Three hours of lecture and discussion per week. The history of human-environmental interaction in America since colonial times. Reviews the prevalent ideas and attitudes during various periods, and the develop ment of the environmental professions. Uses a humanistic and ecological approach to understand the landscape in relation to changes in population, technology, economics, social organizations, and attitudes. Fall or Spring.
Prerequisite: Landscape Architecture major or permission of the instructor. A student may not receive credit for both EIN 371 and EST 371.

EIN 390. Social/Cultural Influences and Environmental Form..........................(3)
Three hours of lecture. This course provides an introduction to an interdisciplinary social science analysis of human settlements. The course introduces the basic concepts, vocabulary, theories, and units of analysis for an interdisciplinary social perspective of the environmental form of human settlements. As such, it focuses upon developing an understanding of the context for the planning and design of human settlements. Course requirements include readings, examinations, and reports. Field trips may be scheduled. Spring.

EIN 471. History of Landscape Architecture ....(3)
Three hours of lecture. Informal lectures and class participation, reports, assigned text and assigned reserve shelf reading, optional text and handout notes, quizzes and exams. Slides. Historical study and style analysis of Western man's efforts to design his environment and his changing attitudes and relationships to environment. Also, non-Western coverage where significant or influential on Western Man. Study of historical personalities as well as periods that are of environmental concern up into the modern period. Fall.
Prerequisite: Permission of the instructor.

EIN 496. Special Topics in Environmental Studies ....(1-3)
Special topics of current interest to undergraduate students in Environmental Studies and related fields. A detailed course subject description will be presented as the topic area is identified and developed. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor.

EIN 510. Creative Problem Solving Seminar ....(3)
Three hours of lecture and discussion. A course designed to extend the student's understanding and application of creative problem solving processes. One requirement will be to select and carry out an application of the techniques to a particular problem, with consultation andguidance from the instructor. Critique and survey of the literature on creativity, in-depth analysis of the synectics process, and various procedures which have been developed for nurturing creative behavior comprise the essence of the program. Spring.

EIN 560. Negotiating Environmental Disputes ....(3)
Two hours of lecture and two hours of recitation/workshop per week. An introductory course to help students acquire and refine skills in listening, problem solving, assertion, and conflict management. These interpersonal skills are useful in many situations; however, the emphasis will be upon using them to resolve environmental conflicts. Approaches to learning will include theory presentation, skill demonstration, skill practice and critique. Fall or Spring.

ENS—ENVIRONMENTAL SCIENCE

ENS 601. Water Resources Management ....(3)
Three hours of lecture and discussion. This course provides an introduction to interdisciplinary water management. It draws upon subject matters from many areas, including water policy, planning, economics, hydrology, law, engineering, and water quality. Fall.

ENS 611. Environmental Institutions ....(3)
Three hours of lecture and discussion per week. Examination of the interrelationships of policymaking and environmental program implementation in government, the role of the legal process in environmental management, and techniques for program evaluation. Fall.

ENS 625. Freshwater Wetlands Assessment and Mitigation (3)
Three hours of lecture, discussion and exercises per week. This course develops principles and methods for functional wetland data collection, delineation, assessment and mitigation/restoration through systematic survey of relevant approaches, methods, literature and field exercises. Fall.

ENS 631. Uncertainty and Environmental Assessment ....(3)
Three hours of lecture/discussion. An analysis of methods for recognizing, quantifying, and assessing uncertainty in policy-driven environmental assessment. Topics include conceptualization and definition of risk and uncertainty, use of probability theory for treatment of uncertainty in environmental assessment, communication of information about uncertain empirical quantities, human judgement in the presence of uncertainty, propagation of uncertainty through mathematical models, and assessment of the implications of uncertainty in quantitative models. Spring.
Prerequisite: Satisfactory completion of APM 395 or an equivalent calculus-based introduction to probability and statistics.

ENS 687. Environmental Law and Policy ....(3)
Three hours of lecture and discussion per week. Study of the legal system and selected federal statutes dealing with environmental protection including the National Environmental Policy Act, Clean Air Act, Clean Water Act and Waste Management Laws.

ENS 696. Special Topics in Environmental Science and Policy ....(1-3)
Experimental and developmental courses in new areas of interest to environmental studies faculty and graduate students not covered in regularly scheduled courses.

ENS 796. Advanced Topics in Environmental Science and Policy ....(1-3)
Lectures and discussions, seminars, conferences, and group research on advanced topics of special or current interest, in fields of interest to environmental studies faculty and graduate students. Fall and Spring.

ENS 797. Environmental Science Seminar ....(1-3)
Discussion of current topics and research related to environmental science. Fall and Spring. Staff.

ENS 798. Problems in Environmental Science and Policy .....(Credit hours to be arranged)
Individualized, special study of environmental science and policy subjects and issues. Comprehensive oral or written report required for some problems. Fall, Spring, and Summer.

ENS 898. Professional Experience ....(1-12)
Professional experience which applies, enriches, and/or complements formal coursework. Graded on an "S/U" basis. Fall, Spring, and Summer.

ENS 899. Master's Thesis Research ....(Credit hours to be arranged)
Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

ENS 999. Doctoral Thesis Research ....(Credit hours to be arranged)
Research and independent study for the doctoral degree and dissertation. Fall, Spring, and Summer.

When choosing courses, students must consult their advisors/major professors.

ERE—ENGINEERING (ENVIRONMENTAL AND RESOURCE ENGINEERING)

ERE 221. Engineering Mechanics—Statics ....(3)
Three hoursof lecture. Forces and vectors, moments, equivalent force systems, free bodies, structures, section propertis. Fall.
Prerequisites: Integral calculus, general physics.

ERE 222. Engineering Mechanics—Dynamics ....(2)
Two hours of lecture. Kinematics and kenetics of particles and rigid bodies; rectangular, normal and tangential, radial and transverse components; translation and rotation; force and acceleration; impulse; momentum; work and energy; impact.
Prerequisites: Statics and Calculus II.

ERE 225. Engineering Graphics ....(1)
Introductory course in graphics as a communication language and analytic/design tool for engineers. One three-hour session each week over the semester utilizing lecture, discussion and hands-on practice to achieve the goals of basic understanding and skill with graphics for the purposes stated. Fall.
Prerequisites: Trigonometry and computer literacy.

ERE 306. Elements of Map and Air Photo Interpretation ....(1)
Two hours of lecture and three hours of laboratory per week for five weeks of a semester. Introduction to map and photograph interpretation to extract information useful to site and resource inventory, analysis, planning, and design activities. The basic physical and geometric properties of maps and photographs, the characteristics of information contained in them, and elementary principles and procedures of interpretation are discussed. Spring.
Prerequisite: College level algebra and plane trigonometry.

ERE 308. Elements of Plane Surveying ....(1)
Two hours of lecture and three hours of laboratory per week for the last five weeks of the semester. Introduction to the principles and procedures of plane surveying for mapping and construction layout purposes. Topics briefly discussed include the basic mathematical principles of surveying, the types and uses of surveying, horizontal and vertical distance measurement, angle measurement, traversing and computations, construction layout, tacheometry, and surveying errors (and their treatment). Spring.
Prerequisite: College level algebra and plane trigonometry.

ERE 310. Environmental Measurements and Spatial Information ....(3)
Two hours of lecture and three hours of laboratory per week. Fundamental concepts for properly collecting data and information about environmental variables. Collecting spatial information is emphasized through consideration of maps, aerial photographs and other imagery, and field surveying procedures. Spring.

ERE 351. Basic Engineering Thermodynamics ....(2)
Principles of energy conservation and conversion: first and second laws. Relation to PVT behavior, property functions, equilibria, and heat and mass transfer. Introduction to engineering problem analysis and computer methods. Spring.
Prerequisites: Physics, general chemistry, and calculus. Not open for credit to students who have completed successfully FCH 360 or equivalent.

ERE 352. Applied Engineering Thermodynamics ....(2)
Classical principles applied to devices and systems. Emphasis on efficient design of manufacturing equipment and processes. Power and refrigeration cycles; energy conservation; materials recovery. Environmental case studies and design project. Computer-aided data correlation and system simulation. Spring.
Prerequisites: ERE 351, FCH 360, or equivalent.

ERE 362. Mechanics of Materials ....(3)
Three hours of lecture. Theories of stress, deformation, and stability of common structural materials subjected to various force systems. Fall.
Prerequisites: Integral calculus and statics.

ERE 364. Engineering Materials ....(3)
Three hours of lecture. An introduction to the study of materials science emphasizing the structure and properties of materials used in the construction industry in general. Lab demonstrations include fabrication, testing and evaluation of actual systems. Spring.
Prerequisites: Junior standing, physics, chemistry, and engineering mechanics.

ERE 371. Surveying for Engineers ....(3)
Two hours of lecture and recitation and three hours of laboratory. The principles of plane surveying for engineers.

Subject matter areas include introduction to the theory of measurement and errors, reference surfaces, linear and angular measurements in both the horizontal and vertical planes, traversing and computations, horizontal and vertical control and associated computations, areal and volumetric computation, construction surveying including circular and parabolic curves, coordinate systems, property and public land surveys, the analysis and treatment of systematic and random errors. Laboratory field work and computations culminate in a topographic map. Elementary computer processing is introduced. Fall.

Prerequisites: Calculus.

ERE 375. Elementary Corrosion .... (1)
One hour of lecture. Basic electro-chemistry, film formation and passivation, galvanic corrosion and pitting, cathodic and anodic protection, protective coatings and inhibitors. Application of the above in the home, car, field, at sea, and in industrial plants. Spring.

ERE 420. Computer Applications in Science and Engineering .. .. (3)
Principles and methods of mathematical modeling for analog and digital computer solution. Applications to data reduction and correlation, statistical analysis, process and equipment simulation, optimization and control, and computer-assisted instruction. Typical examples, class problems and student projects. Current status and future projection of computational equipment, software and operating techniques. Fall.

Prerequisites: Calculus and computer programming, or permission of the instructor.

ERE 435. Environmental Technologies: Water and Wastewater Treatment .... (3)
History, scientific basis, and limitations of selected technologies for water use and reuse. Three hours of lecture per week with extensive reading assignments. Intended for seniors in the Bachelor of Science in Environmental Studies program; open to others after consultation with the instructor. Fall.

ERE 437. Decision Modeling for Environmental Management .... (3)
Three hours lecture/discussion and computer laboratory. Concepts and tools used in environmental management decision modeling. Coverage includes engineering economic analysis, deterministic risk analysis, sensitivity analysis, and probabilistic risk analysis. Graphical presentation of information about cost, risk, and uncertainty. Capabilities and limitations of decision models, role of subjective human values in environmental management decisionmaking. Fall.

Prerequisites: APM 391 or APM 395.

ERE 440. Water Pollution Engineering .... (3)
Two hours of lecture and three hours of laboratory. Introduction to the physical, chemical, and biological parameters of waste water treatment processes and to the principles of the unit operations involved. Study of the design parameters and design procedures of waste water treatment systems. Spring.

Prerequisites: Physics and CHE 356 or equivalent.

ERE 441. Air Pollution Engineering .... (3)
Three hours of lecture and discussions. Study of the chemical, physical and meteorological principles of air pollution and its control. Local and global effects of air pollution. The atmospheric survey. Examination of the operating principles and design parameters of the various air pollution control systems. Air quality and emission standards. Fall.

Prerequisites: Physics and CHE 356 or equivalent.

ERE 450. Introduction to Geographic Information Systems .... (3)
Two hours of lecture and three hours of laboratory per week. Definition, development, and general concepts of Geographic Information Systems (GISs). Topics will include data acquisition and specification, data processing, data manipulation, and analysis, information output, and selecting and implementing GISs. Fall.

ERE 496. Special Topics .... (1-3)
Lectures, readings, problems, and discussions. Topics as announced in the areas of environmental or resource engineering. Fall and/or Spring.

ERE 505. Waste Management .... 3)
A multidisciplinary course. Course begins with foundation materials and progresses through a series of field trips and guest lectures aimed at preparing students to develop and communicate details of feasible alternative designs for waste management facilities/programs for specific case studies. Enrollment limited. Fall.

Prerequisite: Permission of the instructor.

ERE 510. Energy: Alternate Systems .... (3)
Three hours of lecture. An introduction to alternate energy resources and conversion processes. Focus is on relatively small-capacity, decentralized systems and means for judging appropriateness, costs, and impacts of application under varying conditions and needs. Instruction modules on passive and active solar heating, wind energy system, biomass resources and conversion, including ethanol production, methane recovery and wood gasification, and internal combustion cogeneration.

ERE 550. Introduction to Geographic Information Systems .... (3)
Two hours of lecture and three hours of laboratory per week. Definition, development, and general concepts of Geographic Information Systems (GISs). Topics will include data acquisition and position specification, data processing, data manipulation, and analysis, information output, and selecting and implementing GISs. Readings with written assessment will be assigned from the current literature. Participation in a group project is required. Fall.

ERE 552. Fundamentals of Remote Sensing .... (3)
Two hours of lecture and three hours of laboratory per week. Principles and techniques of environmental remote sensing including potentials, limitations, instrumentation, and unique requirements. Procedures and principles of acquiring, analyzing, and using a wide range of imagery types for environmental applications and design. Both qualitative and quantitative interpretation procedures are presented. Oriented for multidisciplinary participation. Fall or Spring.

Prerequisite: College physics and calculus or consent of the instructor.

ERE 563. Photogrammetry I .... (3)
Two hours of lecture and discussion, three hours of laboratory and discussion. Basic photogrammetric and photo interpretation concepts as a means of acquiring reliable data for engineering and management planning. Potentials, limitations, instrumentation and unique requirements are considered. Fall and Spring.

Prerequisite: ERE 371 or equivalent.

ERE 585. Microscopy and Photomicrography .... (3)
Two hours of lecture, one hour of demonstration, 3-5 hours of laboratory. Principles of light microscopy and photomicrography with extensive laboratory practice. Fall.

Prerequisite: Permission of the instructor.

ERE 596. Special Topics .... (1-3)
Lectures, conferences, discussions, and laboratory. Topics in environmental and resource engineering not covered in established courses. Designed for the beginning graduate student or selected upper division undergraduate. Fall and/or Spring.

ERE 642. Water Quality Modeling .... (3)
Two hours of lecture and three hours of laboratory per week. An analysis of the biological, chemical, and physical factors of receiving waters governing the action of wastes and their reactions in receiving waters. Introduction to modeling techniques applicable to water quality management issues. Fall.

Prerequisite: ERE 440 or equivalent as evaluated by the instructor.

ERE 643. Water Pollution Engineering ....(3)
Two hours of lecture and three hours of laboratory. Introduction to the physical, chemical, and biological parameters of waste water treatment processes and to the principles of the unit operations involved. Study of the design parameters and design procedures of waste water treatment systems. Spring.
Prerequisites: Physics and CHE 356 or permission of the instructor.
Note: A student may not enroll in or receive credit for both ERE 440 and ERE 643.

ERE 655. Infrared Remote Sensing Measurements ....(3)
Two hours of lecture comprising an in-depth coverage of the reflective and emissive properties of terrestrial materials in the near-, middle- and thermal-infrared regions of the electromagnetic spectrum. The relationship between factors related to natural resources and the upwelling radiance field will be discussed. Techniques for recording images of the earth in the near- to thermal-infrared region will be considered. This will include a discussion of sensing systems, the atmosphere and relevant optical principles. Focal plane array sensors will be discussed. Every third Fall.
Prerequisites: FEG 350 or FEG 352 or equivalent, at least three semesters of calculus, two semesters of physics.

ERE 656. Optical Remote Sensing Measurements ....(3)
Two hours of lecture comprising an in-depth coverage of the optical properties of terrestrial properties. The relationship between the radiance reflected from the earth's surface and factors related to natural resources will be considered. Techniques for recording images of the earth in reflected radiation in the 0.41.1m region will be discussed. This will include an extensive review of the design principles of imaging sensors. Both digital and analog remote sensing devices will be covered. Optical and electronic design criteria will be covered, together with a discussion of data characteristics. Every third Fall.
Prerequisites: FEG 350 or FEG 352 or equivalent, at least three semesters of calculus, two semesters of physics.

ERE 657. Microwave Remote Sensing Measurements ....(3)
Three hours of lecture comprising a survey of the microwave emissivity and scattering cross section characteristics of a range of features. Techniques for imaging the earth in the microwave region of the electromagnetic spectrum will be discussed. This will include consideration of various ground-based and airborne radars and passive microwave scatterometers. Search and phased array radars will also be considered. Data analysis will be dealt with. Every third Fall.
Prerequisites: FEG 350 or 352 or equivalent, at least three semesters of calculus, two semesters of physics.

ERE 664. Photogrammetry II ....(3)
Two hours of lecture and three hours of laboratory. General analytic photogrammetry including interior and exterior orientation systems, intersection space resection and orientation. Correction of photo coordinates for film deformation, lens distortions, atmospheric refraction and earth curvature. Introduction to photogrammetric plotters. Planning photogrammetric projects, and designing optimum procedures for selected photogrammetric tasks. Fall.
Prerequisite: ERE 563 or equivalent.

ERE 670. Principles of Pulping and Bleaching ....(3)
Two hours of lecture and three hours of laboratory plus literature study of assigned topics, independent project planning and/or laboratory study. Discussion of pulping and bleaching processes. Effects of chemical and physical variables on the wood components and pulp properties; chemistry involved. Experiments in pulping and bleaching and pulp evaluation. Fall.
Prerequisites: Organic, physical, and analytic chemistry.
Note: A student may not enroll in or receive credit for both PSE 461 and ERE 670.

ERE 671. Chemistry of Pulping and Bleaching .(3)
Three hours of lecture. Discussion of the chemistry underlying the commercial pulping and bleaching processes, designed to assist in interpreting the phenomena observed in these operations. Emphasis is placed on those reactions which contribute to delignification and the removal of chromophormic groups in lignin and extractives. Spring.
Prerequisite: FCH 572 or permission of the instructor.

ERE 675. Principles of Unit Operations ....(4)
Three hours of lecture and discussion and one two-hour computation period. Fundamentals of fluid dynamics, heat and mass transfer, appropriate analogies and process applications. Stage operations and computation methods. Application to distillation, extraction, gas absorption, evaporation, crystallization and drying. Design, operation, and computer simulation of equipment. Fall.
Prerequisites: Calculus and physical chemistry or permission of the instructor.

ERE 677. Paper Properties ....(4)
Three hours of lecture, three hours of laboratory, and discussion plus evaluation of literature, independent project planning and/or laboratory study. Evaluation and study of the physical, optical, and chemical properties of paper and the interrelationships existing between paper manufacturing methods, papermaking additives, test results and the ultimate properties desired in the finished paper. Fall.
Prerequisite: Permission of the instructor.
Note: A student may not enroll in or receive credit for both PSE 465 and ERE 677.

ERE 678. Paper Coating and Converting ....(2)
Two hours of lecture plus evaluation of literature, independent project planning, and/or laboratory study. Evaluation and study of the various coating materials and processes used by the paper industry. Introduction to polymers and their use in converting operations, fundamentals and parameters which control their use, effects on final properties of papers. Spring.
Prerequisite: PSE 465 or permission of the instructor.
Note: A student may not enroll in or receive credit for both PSE 466 and ERE 678.

ERE 682. Transport Processes ....(3)
Two hours of lecture and three hours of laboratory. The relationship between wood structure and wood permeability, moisture movement, and heat transfer. Fire retardant and wood preservation treatments. Wood drying. Unsteady-state transport processes. An advanced laboratory problem with report in wood-moisture relationships, wood drying, the relationship between wood permeability and treatability, or wood preservative treatments. Spring.
Prerequisite: Permission of the instructor.
Note: A student may enroll in or receive credit for WPE 326 and WPE 327 or ERE 682.

ERE 684. Mechanical Properties of Wood ....(3)
Two hours of lecture and three hours of laboratory. The effect of the anatomical and chemical nature of wood on its response to static and dynamic force systems. The theory of elasticity as applied to wood and wood-based composites. Spring.
Prerequisite: Permission of the instructor.

ERE 685. Transmission Electron Microscopy ....(5)
Two hours of lecture, two hours of laboratory/demonstration, minimum of ten hours of individual laboratory. The theory and operation of the transmission electron microscope including specimen preparation, photographic technique and interpretation of micrographs. Fall.
Prerequisite: Consultation with the instructor.

ERE 686. WoodWater Relationships ....(3)
Two hours of lecture and three hours of laboratory. Relationship between wood moisture content and the environment, electrical and thermal properties, theories of moisture sorption, hygroscopic swelling and shrinking, thermodynamics of moisture sorption, mechanism of moisture movement as it relates to

activation theory. Laboratory exercises will complement the theoretical topics discussed in the lecture. Fall.
Prerequisite: Permission of the instructor.

ERE 688. Tropical Timbers in Commerce.........(2)
Two hours of lecture. Introduction to the commercial use of tropical timbers; the factors of forest conditions, stand types and wood qualities influencing their utilization and the development of trade. Sources of information. Spring.
Prerequisite: Permission of the instructor.

ERE 689. Tropical Wood Anatomy...........................(1)
Anatomical characters, identification and taxonomy of tropical woods important in commerce. Spring.
Prerequisite: WPE 386 or WPE 387. Recommended that ERE 688 be taken concurrently or previously.

ERE 691. Air Pollution Engineering ....(3)
Three hours of lecture and discussion. Study of the chemical, physical, and meteorological principles of air pollution and its control. Local and global effects of air pollution. The atmospheric survey. Examination of the operating principles and design parameters of the various air pollution control systems. Air quality and emission standards. Fall.
Prerequisites: Physics and CHE 356 or permission of the instructor.
Note: A student may enroll in or receive credit for both ERE 441 and ERE 691.

ERE 760. Analytical Photogrammetry I ....(3)
Two hours of lecture and three hours of laboratory. Mathematical theory of photogrammetry including space resection, orientation, intersection and aerial triangulation. Spring.
Prerequisites: FEG 363, APM 360 and FEG 464 or equivalent.

ERE 785. Scanning Electron Microscopy ....(5)
Two hours of lecture/demonstration/laboratory. Ten hours of independent laboratory experience per week. The theory and operation of the scanning electron microscope including specimen preparation, photographic technique and interpretation of micrographs. Spring.
Prerequisite: Permission of the instructor.

ERE 790. Advanced Image Analysis ....(3)
Two hours of lecture, plus laboratory. In this course, the acquisition of both analog and digital imagery will be considered. The relationship between the scene and the image will be considered as a precursor to digital image operations which may be performed to solve specific problems. Operations performed upon image planes to provide a two-dimensional image of use to the interpreter will be discussed. Various digital image analysis techniques will be covered. Fall or Spring.
Prerequisites: FEG 350 or 352 or equivalent, at least three semesters of calculus.

ERE 796. Advanced Topics ....(1-3)
Lectures, conferences, discussions, and laboratory. Advanced topics in Forest Engineering, Paper Science and Engineering, and Wood Products Engineering. Fall and/or Spring.
Prerequisite: Permission of the instructor.

ERE 797. Seminar ....(1-3)
I. Forest Engineering topics. II. Paper Science and Engineering topics. III. Wood Products Engineering topics. Fall and Spring.

ERE 798. Research in Environmental and Resource Engineering ....(Credit hours to be arranged)
I. Independent research topics in Forest Engineering. II. Independent research topics in Paper Science and Engineering. III. Independent research topics in Wood Products Engineering. Fall, Spring, and Summer.

ERE 899. Master's Thesis Research ....(Credit hours to be arranged)
Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

ERE 999. Doctoral Thesis Research ....(Credit hours to be arranged)
Research and independent study for the doctoral degree and dissertation. Fall, Spring, and Summer.

ESF—NONDEPARTMENTAL

ESF 332. Seminar for New Transfer Students ......(No Credit)
One hour of weekly lectures and discussions designed to introduce the transfer student to the College and its academic and social environs. Fall and Spring.

EST—ENVIRONMENTAL STUDIES

EST 300. Introduction to Environmental Studies ....(3)
Two hours of lecture and discussion and three hours of workshop per week. An introduction to the interrelationships among the natural environment, people, and the human environment. An experiential learning approach is used to develop critical facilities and systems thinking useful for assessing environmental issues. Fall.

EST 311. Natural Processes in Planning and Design ....(3)
Three hours of lecture and discussion per week. An overview presentation of the basic principles governing the dynamics of natural resources and processes and their implication for the planning, design, and management of natural and human environments. Sources and use of environmental data are discussed and illustrated. Occasional field trips may be required. A student may not receive credit for both EIN 311 and EST 311. Fall.

EST 321. Government and the Environment ....(3)
Three hours of lecture and discussion. An investigation of institutional influences on the American environment. Federal government and its role in environmental management and protection is emphasized. The pressures contributing to the formation of environmental policy are introduced. The practical consequences of this system are demonstrated through case studies. Fall.

EST 390. Social Processes and the Environment ....(3)
Three hours of lecture and discussion. A multidisciplinary social science perspective on the nature of the physical environment, particularly as it relates to the creation of human habitat. Human-environment interactions are viewed at three scales: (1) macro-interactions concerning social and economic issues; (2) meso-interactions concerning behavior of groups; (3) micro-interactions concerning perceptions and attitudes of individuals. Disciplines from which material may be drawn include: anthropology, ethology, geography, political science, psychology, and sociology. Spring.

EST 400. Senior Paper ....(3)
Individual study of an environmental topic resulting in a formal report that meets the requirements for an Environmental Studies synthesis experience. These requirements are identified in course meetings. Enrollment is restricted to Environmental Studies seniors. Fall and Spring.

EST 495. Selected Readings in Environmental Studies ...(1-3)
An in-depth and independent exploration of selected readings from the environmentally related literature. Emphasis is placed on gaining insights and understanding from the readings, rather than producing an extensive bibliography. Fall, Spring and Summer.
Prerequisite: Approval of study plan by the instructor.

EST 496. Special Topics in Environmental Studies ....(1-3)

subject description will be presented as the topic area is identified and developed. Fall, Spring, and Summer.

Prerequisite: Permission of the instructor.

EST 498. Introductory Research Problems...(1-3)
Guided individual study of an environmental topic. Emphasis is on the study procedure and the methods employed. Enrollment is possible at various times during the semester. Fall, Spring, and Summer.

Prerequisite: Approval of study plan by the instructor.

EST 499. Environmental Studies Internship..............(1-12)
Internships provide students with a supervised field experience to apply and extend their academic abilities in a professional working environment. Enrollment is possible at various times during the semester. Fall, Spring, and Summer.

Prerequisite: Environmental Studies senior standing and written approval of an internship contract by major professor, curriculum director, and field supervisor.

FCH—FOREST CHEMISTRY

FCH 221. Organic Chemistry I................................(3)
Three hours of lecture. The structure, properties, and fundamental reactivity of organic compounds will be studied with emphasis on the reaction mechanisms and stereochemistry. In combination with FCH 223, this course provides a full survey of common classes of carbon compounds. Fall.

Prerequisites: One year of general chemistry.

FCH 222. Organic Chemistry Laboratory I ....(2)
One hour of pre-laboratory instruction. Three hours of laboratory. Laboratory safety. Melting and boiling points, distillation, recrystallization, thin-layer and column chromatography, and isolation of natural products. Qualitative functional group analysis. Fall.

FCH 223. Organic Chemistry II ....(3)
Three hours of lecture. The structure, properties, and fundamental reactivity of organic compounds will be studied with emphasis on the reaction mechanisms and stereochemistry. In combination with FCH 221, this course provides a full survey of common classes of carbon compounds. Spring.

Prerequisite: FCH 221 Organic Chemistry I or equivalent.

FCH 224. Organic Chemistry Laboratory II ....(2)
Four hours of laboratory including pre-laboratory instruction. Continuation of FCH 222. Simple physical and instrumental techniques applied to organic chemistry. Gas chromatography, polarimetry, kinetics. Introduction to classical literature syntheses. Spring.

Prerequisite: FCH 222 or equivalent.

Corequisite: FCH 223 or equivalent.

FCH 325. Organic Chemistry III ....(4)
Two hours of lecture, one six-hour laboratory. Classical and recent literature synthesis or organic compounds, employing advanced tech niques. Fall.

Prerequisite: Two semesters of elementary organic chemistry.

FCH 360. Physical Chemistry I ....(3)
Three hours of lecture. Includes discussion on the properties of gases and liquids, laws of thermodynamics, solutions and colligative properties, and electrochemical cells. Fall.

Prerequisites: One year of college physics, differential and integral calculus.

FCH 361. Physical Chemistry II..............................(3)
Three hours of lecture. Includes discussion on electrochemistry, principles of quantum mechanics, statistical mechanics, chemical kinetics, and basic spectroscopy. Spring.

Prerequisite: FCH 360 Physical Chemistry or the equivalent.

FCH 380. Analytical Chemistry I: Gravimetric, Titrimetric and Potentiometric Analysis.(3)
Two hours of lecture and one three-hour laboratory. Equilibrium concepts and practical implementations of precipitation, complexation, acid-base, and oxidation-reduction processes in quantitative chemical analysis. Fall.

Prerequisites: Two years of undergraduate chemistry and FCH 360 (or equivalent) taken concurrently or permission of the instructor.

FCH 381. Analytical Chemistry II: Spectroscopic, Chromatographic and Electroanalytical Instrumental Techniques ....(3)
Two hours of lecture and one three-hour laboratory. Theory and practice of technology applications to UV/VIS, AAS, AES, XES, ASV, GLC, and HPLC. Spring.

Prerequisites: Two years of undergraduate chemistry and FCH 380, FCH 361 (or equivalent) taken concurrently or permission of the instructor.

FCH 384. Spectrometric Identification of Organic Compounds ....(1-2)
Two hours of lecture and discussion. The first half semester (1 credit) will deal with common classes of organic compounds; the second half semester (1 credit) will deal with more complex structures. The use of complementary information from mass, infrared, nuclear magnetic resonance, and ultraviolet spectrometry will be applied to identification of organic natural products. Spring.

Prerequisites: Organic chemistry; one semester of advanced organic chemistry for second credit.

FCH 390. Drugs from the Wild ....(3)
Three hours of lecture and discussion each week. This course is designed to give students a comprehensive understanding of the variety of medicinal agents available from natural sources. Economic and societal aspects will be explored as well as scientific ones. In addition to curative agents, discussions will include toxic substances, folk medicinal (including herbal) preparations, and the so-called "recreational drugs."

Prerequisites: Introductory courses in chemistry and biology.

FCH 440. Introduction to Chemical Ecology.....(3)
Three hours of lecture with discussion. Centers on chemical signals among organisms from microbes to man as they affect ecology, physiology, and behavior and as they can be utilized for agriculture, pest management, and animal husbandry.

Prerequisites: Biology (one year), and organic chemistry (one year).

Note: Also listed as EFB 412.

FCH 495. Introduction to Professional Chemistry ....(1)
The professional chemist and his relationship with industry, government, and universities. Employment opportunities for the chemist, professional organizations, and unions will be discussed. The selection of a senior research topic and a literature survey will be required. Fall.

Prerequisite: Senior status.

FCH 496. Special Problems in Chemistry..................(1-3)
An opportunity for a special problem, technique development, independent or unstructured study in an area related to the chemical profession. The work may be technical, professional, or interdisciplinary. Advisors outside this department may be solicited. A brief proposal must be presented for approval with specific arrangements outlined including faculty advsior and objectives of the study. Evidence of competence an appropriate effort is required for credit. A written report will be expected Fall and Spring.

Prerequisite: Upper division status.

FCH 497. Undergraduate Seminar............................(1)
One hour per week. Literature surveys and seminars on topics of current research interest and recent advances in chemistry. Spring.

FCH 498. Introduction to Research................(5)
Eighteen hours of laboratory, library search and report writing. Solution of a selected research problem using special laboratory techniques. Typewritten report on data, procedures, results, and conclusions. Spring.

FCH 510. Environmental Chemistry I..............(3)
Three hours of lecture. Introduction to the processes that control chemical behavior in aquatic environments, including precipitation, gas exchange, acid-base, redox, complexation, and adsorption reactions. Emphasis will be on explanation and prediction of chemical behavior, using computer models where appropriate. Examples will be from the areas of water and wastewater treatment, pollutant fates and geochemistry. Fall.
Prerequisites: An introductory course in physical chemistry is required and a shortcourse in computer programming is recommended.

FCH 511. Environmental Chemistry II ....(3)
Three hours of lecture. Includes a detailed chemical explanation of current topics of concern in environmental chemistry and the chemistry of pollution. Lectures will cover topics relating to air, soil and biota pollutional impact. Spring.
Prerequisite: Chemistry through physical chemistry, or consent of the instructor.

FCH 515. Methods of Environmental Chemical Analysis ....(3)
One hour of lecture and six hours of laboratory. An introduction to sampling, analytical and quality control procedures necessary to obtain reliable water quality data. All analyses will be performed on a single aquatic system with the purpose of developing a final report characterizing the water quality of that system. Fall.
Prerequisite: A course in quantitative chemical analysis.

FCH 519. Environmental Chemistry Seminar ....(1)
One hour of lecture. Seminars on current research and issues in environmental chemistry and related areas. Spring.

FCH 520. Nuclear and Radiation Chemistry ....(2)
The two one-hour lectures will cover the information required for the basic understanding of nuclear reactions, the types of radiation emitted, the instrumentation necessary to detect and measure this radiation, the principles of radioisotope tracer techniques, and radiation chemistry which is the effect of radiation on organic systems. Visits to the Cornell Reactor and the Nuclear Medicine Department of the SUNY Health Science Center at Syracuse will be arranged. Spring.
Prerequisites: Physical, organic and inorganic chemistry or by permission of the instructor.
Note: This course can be taken independently of FCH 521.

FCH 521. Nuclear Chemical Techniques ....(1)
The laboratory will consist of one four-hour laboratory class every two weeks, with one hour to be made up at the student's discretion to accommodate counting periods which extend over several weeks. A short movie by the AEC each week will be required for the sixth hour. The laboratory will give each student the opportunity to use the individual counting instruments, gain experience in the handling and preparation of radioactive samples and the use of the 1000-curie-cobalt source in radiation chemistry. Spring.
Prerequisite: Physical, organic, and inorganic chemistry or permission of the instructor. Advanced tentative registration is required.
Corequisite: FCH 520.

FCH 524. Topics in Natural Product Chemistry..............(3)
Three hours of lecture and discussion each week. A course intended to introduce the student to various types of secondary metabolites including several of past and current interest because of their pronounced biological activities. Modes of chemical reactivity and means of structure determination and syntheses are covered. Spring.

FCH 530. Biochemistry I...............................(3)
Three hours of lecture. General biochemistry with emphasis on cellular constituents and metabolic reactions. The chemical, physical, and biological properties of amino acids, proteins, carbohydrates and their intermediary metabolism will be discussed. The chemistry of enzymes, energy transfers, and biological oxidations will also be covered. Fall.
Prerequisite: One year of organic chemistry.
Recommended: Physical chemistry.

FCH 531. Biochemistry Laboratory...........................(2)
Six hours of laboratory. This course will stress techniques used in biochemical research. Techniques used include various types of chromatography, electrophoresis, spectrophotometry, and methods involved in the isolation, purification and assay of enzymes and nucleic acids. Fall.
Prerequisite: One semester of quantitative analysis with laboratory.

FCH 532 Biochemistry II......................................(3)
Three hours of lecture. Topics discussed are: biosynthesis and degradation of amino acids and nucleic acids, protein biosynthesis, and an introduction to molecular biology. Spring.
Prerequisites: FCH 530 and its pre- and co-requisites.

FCH 550. Introduction to Polymer Science I: Polymer Synthesis and Mechanisms ....(3)
Three hours of lecture. Introduction to the synthesis of polymers and the mechanism of polymerization processes. Addition homopolymerization and copolymerization by radical, ionic and coordination type catalysts. Synthesis of block and graft copolymers. Stepwide polymerization, network formation and gelation. Structure of polymers and stereoregular polymerization. Degradation of polymers, reaction on polymers, polyelectrolytes. Fall.
Prerequisites: One year of organic chemistry and one year of physical chemistry.

FCH 551. Polymer Techniques...............................(2)
One hour of lecture/discussion and three hours of laboratory; lab reports, final exam. Ten experiments covering the main topics of polymer synthesis (2), molecular weight determination (4), and characterization (4) are selected from free-radical solution and emulsion polymerizations, copolymerization, condensation polymerization, osmometry, viscometry, light scattering, gel permeation chromatography, polarized light microscopy, X-ray diffraction, differential scanning calorimetry, thermogravimetric analysis, stress-strain analysis, nuclear magnetic resonance. Fall.
Prerequisites: One year of organic and one year of physical chemistry.

FCH 552. Introduction to Polymer Science II: Polymer Properties and Technology ....(3)
Three hours of lecture. Introduction to the physical chemistry, physics, processing and technology of synthetic polymers. Polymer solutions, including molecular weight determinations and chain statistics. Polymer solid states, including rubber elasticity,, viscoelasticity, the glassy state and the crystalline state. Properties, processing and technology of films, fibers, elastomers and foams. Spring.
Prerequisites: One year of organic chemistry and one year of physical chemistry.

FCH 560. Chromatography and Related Separation Sciences ....(3)
Three hours of lecture and discussion each week. A course designed to give the student a thorough understanding of analytical and isolation chemistry by modern chromatographic, distributive and molecular sieving techniques. The chemistry of the systems discussed will be stressed as well as the important physical aspects. Spring.
Prerequisites: Two semesters each of organic and general chemistry.

FCH 571. Wood Chemistry I: General Wood Chemistry ....(2)
Two hours of lectures. Introduction to carbohydrate chemistry. Chemistry of cellulose, hemicelluloses, and lignin. Cellulose derivatives. Distribution of polysaccharides and lignin in wood. Wood extractives. Chemistry of bark. Formation of heartwood. Wood as a chemical raw material. Fall.
Prerequisite: One or two semesters of a three-credit undergraduate course in organic chemistry.

FCH 572. Wood Chemistry II: Wood and Pulping... Chemistry ....(3)
Three hours of lectures. Introduction to carbohydrate chemistry. Chemistry of cellulose, hemicelluloses, and lignin. Cellulose derivatives. Distribution of polysaccharides and lignin in wood. Wood extractives. Chemistry of bark. Formation of heartwood. Wood as a chemical raw material. Chemistry of the industrial pulping processes with emphasis on sulfite and kraft pulping of wood. Chemistry of the major bleaching agents. Chemical byproducts in the pulping industry. Complete tree utilization in the manufacture of pulp and paper. Fall.
Prerequisite: One or two semesters of a three-credit undergraduate course in organic chemistry.

FCH 573. Wood Chemistry III: Biosynthesis of Wood ...... (2)
Two hours of lecture. Chemistry of pectin and starch. Photosynthesis with emphasis on the chemical phase. Chemistry of the primary cell wall in plants. Biosynthesis of cellulose, hemicelluloses, pectin, and starch. Biosynthesis of aromatics, including lignin. Biodegradation of wood. Spring;
Prerequisite: FCH 571 or an equivalent course in general wood chemistry.

FCH 600. Interrogating Computer-Based Chemical Science Databases .... (1)
One hour of lecture per week and scheduled time on the computer facilities for solving the assignments. A review of manual searching methods and the structure of the chemical abstracts in its text form. Principles and practice in computer-aided searching of the chemical science, especially chemical literature. A term project requires each student to design, conduct and analyze a literature search. Structured problems in computerized literature searches will also be assigned. Both structure and concept-based methods of searching will be treated. Fall.
Prerequisite: Graduate standing in chemistry or permission of the instructor.

FCH 630. Plant Biochemistry .... (3)
Three hours of lecture and discussion. Includes the biochemistry of photosynthetic electron transport and phosphorylation,, photosynthetic carbon fixation, photoespiration, nitrogen fixation,, nitrate reduction, photochrome, and plant hormones. The economic,, ecological and environmental aspects of plant biochemistry will also be discussesd. Spring.
Prerequisites: FCH 530-532 or FCH 539 or equivalent.

FCH 650. Physical Chemistry of Polymers I .... (3)
Three hours of lecture. Includes: thermodynamics of polymer solutions, phase equilibria, fractionation, structure-property relationships, elementary chain statistics, molecular geometry, network elasticity, polyelectrolyte theory, and viscocity. Fall.
Prerequisites: One year of organic chemistry and one year of physical chemistry.

FCH 651. Physical Chemistry of Polymers II .... (3)
Three hours of lecture. Viscoelasticity. The glassy state and glass transition temperature. The crystalline state and crystalization kinetics. Characterization of structure and morphology of polymer solid states. Survey of structure and properties of native polymers. Spring.
Prerequisites: One year of organic and one year of physical chemistry.

FCH 652. Organic Chemistry of Polymers I .....(2)
Two hours of lecture. A broad survey of the chemistry of polyfunctional molecules and methods for their conversion to high molecular weight materials. Synthesis of a variety of specialty polymers and chemical reactions on natural and synthetic polymers. Some relations between molecular structure and useful properties. Fall.
Prerequisite: One year of organic chemistry.

FCH 653. Organic Chemistry of Polymers II.....(3)
Three hours of lecture. Kinetics and mechanism of polymerization processes, with emphasis on addition polymerization reactions initated by radical, cationic and anionic initators. Mechansim of sterospecific polymerization. Structure of polymers. Reactions on polymers and their modification for specific end uses. Block and graft polymers. Spring.
Prerequisites: One year of organic chemistry and one year of physical chemistry.

FCH 796. Special Topics in Chemistry .... (1-3)
(Credit hours arranged according to nature of topic)
Lectures, conferences, and discussion. Advanced topics in physical chemistry, organic chemistry, or biochemistry. Fall and Spring.

FCH 798. Research in Chemistry
(Credit hours arranged according to nature of problem)
Independent research in physical and organic chemistry of synthetic polymers, physical and organic chemistry of natural polymers, organic chemistry of natural products, ecological chemistry and biochemistry. One typewritten report required. Fall, Spring, and Summer.

FCH 899. Master's Thesis Research
.... (Credit hours to be arranged)
Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

FCH 997. Seminar ....(1)
Seminars scheduled weekly; an average of 20 to 30 seminars are given annually. Discussion of recent advances in chemistry. Credit is given only once to a student. Fall and Spring.

FCH 999. Doctoral Thesis Research
.... (Credit hours to be arranged)
Research and independent study for the doctoral degree and dissertation. Fall, Spring, and Summer.

FEG—FOREST ENGINEERING

FEG 340. Engineering Hydrology, and Flow Controls .... (4)
Three hours of lecture and three hours of laboratory and discussion. Analysis of the waters of the earth, their occurrence, circulation, and distribution; physical properties and their interaction with their environment. Principles of hydrologic budgeting and routing; and basic hydraulics of open channel, conduit, groundwater and overland flow. Applications of probability as a basis for the design of solutions to groundwater, surface runoff, flooding and water supply problems. Spring.
Prerequisites: CIE 327, IOR 326, and APM 360.

FEG 350. Introduction to Remote Sensing for Engineers ... (2)
Two hours of lecture per week. The fundamentals of acquiring, analyzing, and utilizing remote sensing data in the performance of natural resource inventories, environmental quality surveys and site development analyses. Oriented for multidisciplinary participation.
Prerequisite: Junior standing.

FEG 352. Introduction to Remote Sensing ......(3)
Two hours of lecture and three hours of laboratory per week. Qualitative and quantitative introduction to the fundamentals of acquiring, analyzing, and utilizing remote sensing data in the

performance of natural resource inventories, environmental quality surveys, site development studies, and land use analyses. Oriented for multidisciplinary participation. Fall and Spring.
Prerequisites: Junior standing, physics and calculus or consent of the instructor.

FEG 363. Photogrammetry I ....(3)
Two hours of lecture and discussion, three hours of laboratory. Basic photogrammetric and photo interpretation concepts as a means of acquiring reliable data for engineering and management planning. Potentials, limitations, instrumentation, and unique requirements are considered. Fall or Spring.
Prerequisite: ERE 371 or equivalent.

FEG 410. Structures ....(4)
Three hours of lecture, three hours of computation laboratory and discussion. Engineering principles in the analysis, planning design and construction of components and framed structures under various types of loadings. The proportioning of wood, steel and concrete members and the design of statically determinate structural systems. Emphasis is placed on the relationship between theoretical stress analysis and codes and specifications for appropriate materials and structural design practices. Fall.
Prerequisites: ERE 362, APL Computing.

FEG 420. Harvest Systems Analysis ....(1)
Three hours of discussion, demonstration and/or field exercises. An introduction to mensuration, harvesting operations, methods analysis, mechanization, and interrelationships between the production and silvicultural aspects of harvesting, is presented. A context is developed for the application of other Forest Engineering courses.
Prerequisites: FOR 321, ERE 362.

FEG 430. Engineering Decision Analysis ....(3)
An introduction to the design process as a decision model, with emphasis on determining economic attractiveness of engineering projects, and evaluation of investment alternatives. Analysis of production and construction activities in private and public works activities. Fall.
Prerequisite: IOR 326.

FEG 437. Transportation Systems ....(3)
Two hours of lecture and three hours of laboratory. Interrelationshipsbetween natural features, transportation types, design, and management objectives to provide the most effective system within a given framework. Basic engineering principles in the planning, location, design, construction, and maintenance of suitable transportation systems to serve various aspects of forest resource management.
Prerequisites: ERE 371, CIE 437, FEG 340.

FEG 448. Advanced Topics in Hydraulics ....(3)
Three hours of lecture per week. Classroom instruction and exercises introduce advanced concepts in hydraulics. Topics include the energy and momentum principles, critical flow, uniform flow, flow profiles, and unsteady flow, as appropriate. Suitable as an engineering design elective in the forest engineering curriculum. Fall.
Prerequisite: FEG 340 or equivalent as determined by the instructor.

FEG 454. Power Systems ....(2)
Two hours of lecture per week. Application of alternative technologies to the matching of power needs and resource constraints. Topics include tractive power, wind power, cogeneration, alternative fuels, and photovoltaics.
Prerequisites: MEE 285, ERE 351, FEG 420.

FEG 464. Photogrammetry II ....(3)
Two hours of lecture and three hours of laboratory. General analytic photogrammetry including interior and exterior orientation systems, intersection, space resection, and orientation. Correction of photo coordinates for film deformation, lens distortions, atmospheric refraction, andearth curvature. Introduction to photogrammetric plotters. Planning for photogrammetric projects and designing optimum procedures for selected photogrammetric tasks. Fall.
Prerequisite: FEG 363.

FEG 489. Forest Engineering Planning and Design ....(3)
Two hours of lecture and three hours of laboratory. A curriculum capstone course designed to integrate other coursework with a systematic approach to real life engineering problems. Semester-long laboratory projects are selected to provide experience in dealing not only with technical and economic constraints, but also with environmental, social, legal, and political aspects of the planning process. Spring.
Prerequisite: Senior standing in forest engineering.

FEG 498. Research Problem in Forest Engineering ....(1-3)
Independent research in topics in Forest Engineering for the highly motivated undergraduate student. Selection of subject area determined by the student in conference with appropriate faculty member. Tutorial conferences, discussions and critiques scheduled as necessary. Final written report required for departmental record. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor.

FOR—FORESTRY (RESOURCES MANAGEMENT)

FOR 200. Introduction to Resources Management ....(2)
Two-three hours of lecture/discussion. An introduction to forestry and the professional disciplines related to forest resources management. Topics include the scope and purposes of forestry, application of basic scientific concepts in planning forest resources management, approaches to integrating the management of forest-related resources and values, professionalism and ethics, and a review of current issues of importance to forestry. Required for resources management students and highly recommended for Dual EFB/FOR students. Open to all other students. Fall.

FOR 205. Introduction to Macroeconomics ......(3)
Three hours of lecture per week. The role of macroeconomic theory in public policy will be emphasized. Basic macroeconomic models of the banking system and of the interplay of consumer, business firms and government purchases of goods and services will be used in the analysis of public policy with respect to stability of consumer prices and the level of employment in the economy, the role of foreign trade in the performance of the national economy.

FOR 206. Introduction to Microeconomics ....(3)
Three hours of lecture per week. Consumer behavior, pricing and resource allocation, and the theory of the firm and industry will be emphasized. The role of microeconomic theory in public policy analysis.

FOR 296. Special Topics in Resource Management/Forestry ....(1-3)
Experimental, interdisciplinary or special coursework at the freshman or sophomore levels. Subject matter and course format vary from semester to semester or offering on the basis of needs and objectives of the course. Fall or Spring.

FOR 301. Field Dendrology ....(1)
Approximately one half-day lecture, five eight-hour field study, presented as the first portion of the Summer Program in Field Forestry held at Pack Demonstration Forest, Warrensburg, N.Y. Field identification and ecology of common woody species of the southeastern Adirondack area. Natural and cultural history of the area as it affects the growth and development of these species. Summer.

FOR 302. Forest Surveying and Cartography ....(2-1/2)
Course consists of approximately 13 eight-hour class days, combining lectures and practical field applications. The course

stresses development of functional ability in the areas of cartography, overland navigation, and land measurement. It is part of the Summer Program in Field Forestry held at Pack Demonstration Forest, Warrensburg, N.Y. Summer prerequisite for FOR 303, 322, 332.

Prerequisite: FOR 301.

FOR 303. Introduction to Forest Resource Measurements (Summer Field Session) .... (3-1/2)
Lecture and field practice on methods and procedures for measuring trees, forest stands, and forest products. Descriptive statistics and sampling are introduced as they relate to the measuring process. Emphasis is placed upon field procedures and performance.

FOR 304. Introduction to Forestry .... (1)
Approximately one day of lecture and at least four all day field trips, presented as an integral part of the Summer Program in Field Forestry. Students will be introduced to the diversity of forestry and the activities of a professional forester, and will visit forestry field operations and woodusing industries. Summer.

FOR 305. Forestry Concepts and Issues .... (1)
Three hours of lecture/discussion; starts approximately midsemester. An introduction to environmental attitudes and values as they relate to forestry and natural resource professionalism and practice. Current issues are used as examples. Required for Resource Management juniors and Dual RM/Forest Biology students. Fall.

FOR 307. Environmental Economics .... (3)
Three hours of lecture and discussion per week. Economic theory and analysis in the control of external economies and diseconomies in the use of resources. Particular emphasis is placed upon the study and application of economic models to the problems of pollution of air, water, and land. Relationships and interactions of the public and private sectors in the creation and control of externalities.

FOR 321. Forest Ecology and Silviculture .... (3)
Two hours of lecture and one three-hour field laboratory first half of semester; three hours of lecture last half of semester. Survey of forest tree and stand ecology and silviculture concepts and implications for treatment of forest stands for various values. Some field evaluation of forest stands, site and history variables, and treatment alternatives. For students outside Resources Management curriculum; not open to students taking FOR 332 and 334. Fall.

Prerequisite: Botany or general biology.

FOR 322. Forest Resource Measurements .... (2)
Two hours of lecture and one three-hour laboratory per week in first two-thirds of semester. Principles and methods used in the measurement of trees and forest stands, theory and application of forest measurements as applied to non-commodity resource uses, and introduction to the concept of forest growth and yield analysis. Fall.

Prerequisite: FOR 303 or equivalent.

FOR 331. Forest Influences .... (3)
Two lecture/discussion sessions and one laboratory/field session per week. Forest vegetation as a modifier of the local fluxes of energy and water. Required for Resource Management juniors and Dual RM/Forest Biology students. Fall.

FOR 332. Silvics .... (3)
Three hours of lecture, or two hours of lecture with three hours of laboratory per week. Course stresses understanding of autecology and synecology as they apply to the creation of specific forest stand structures, dictated by varying management objectives (recreation, water, wildlife, wood).

Prerequisites: Botany and general ecology.

Corequisites: Soils, and forest influences (or equivalent prerequisites).

FOR 333. Silvics/Lab Practicum .... (1)
Five hours of field/laboratory exercise per week in selected weeks. Course stresses practical experience as a means to increase understanding and articulation of: 1) autecology and synecology, and 2) the creation of specific forest stand structures dictated by varying management objectives (recreation, water, wildlife, wood). Computer methods, problem analysis techniques, and a professional seminar are part of the practicum.

Prerequisites: Botany and general ecology.

Corequisites: Silvics, soils, and forest influences (or equivalent prerequisites).

FOR 334. Silviculture .... (4)
Three hours of lecture and 3 hours of laboratory or field trip per week. Study of the practice of silviculture for managing forest stands to serve various interests of landowners. Field trips and exercises provide opportunities to see examples of common silvicultural methods under different management scenarios, and to learn and practice techniques for ânalyzing forest stands and developing prescriptions for their treatment. Fall.

Prerequisite: Concurrent or earlier courses in forest soils, forest in-fluences, silvics, and forest mensuration, or equivalent.

FOR 335. Regional Silviculture .... (3)
Three hours of classroom study. Topics cover regional factors that influence silvicultural methods commonly used in different forest types. Provides study of various silvicultural systems used in operating forest properties in various regions, with attention to geographical differences in land use, market opportunities, species characteristics, and economic conditions. Spring.

Prerequisite: FOR 332 or FOR 321.

FOR 341. Watershed Hydrology and Water Quality .... (1-3)
One to three hours of lecture in classroom and field. Basic principles of watershed hydrology, natural water quality, and interactions between rural lands' management practices and water quality, especially the substantive basis underlying and best management practices for application of agricultural and silvicultural nonpoint sources on rural lands.

Prerequisite: Permission of the instructor.

FOR 345. Soils .... (3)
Two hours of lecture and three hours of laboratory. Introduction to the fundamentals of soil science with particular reference to forestry, but including other land uses. Fall and Spring.

Prerequisites: Introductory courses in chemistry and physics.

FOR 360. Principles of Management .... (3)
Three hours of lecture and case discussion. Basic principles and concepts of management which are applicable to any organization, business enterprise, or public agency. The various approaches to management including the classical, behavioral, and quantitative with emphasis upon the integrative approach to meet society's changing life styles, values, and awareness of environmental matters and natural resources management. Spring.

FOR 361. Computing in Forestry .... (3)
Introduction to the use of the computer in forestry and to the BASIC programming language. Commonly used forestry techniques are implemented by the student on the computer and the student has the opportunity to use other professionally prepared programs. The student also uses the computer as a communication device. The course is designed for students in the forestry curriculum. Open to other students by permission of the instructor.

Prerequisite: An introductory course in computers.

FOR 363. Management Models .... (3)
Introduction to the various models used in managerial decisionmaking. Emphasis is on the characteristics of the various models: Their formulation, assumptions, uses and limitations. The major topics covered will include: The role of models in management; simple optimization; constrained optimization; multi-valued choices; time adjustment of value; simulation; and models in nondeliberated decisions. Integration of the deliverative and intuitive models is stressed. Spring.

FOR 364. Soil and Water Conservation Policy . (3)
Three hours of lecture. An integrated, historical survey of water and related land resource conservation in the United States. Interrelationships of governments and private organizations in their functions of policy-setting and planning, administration of programs, and evaluation of projects. Three lectures per week. Spring.

FOR 372. Fundamentals of Outdoor Recreation .... (3)
Introduction to the programs and practices of federal, state and local agencies and private organizations involved in planning, administration and management of outdoor recreation areas. Emphasis is on major recreational issues and conflicts faced by area managers, and how they integrate solutions into their plans. Spring and Fall.
Prerequisite: Junior standing.

FOR 373. Timber Harvesting .... (3)
Two hours of lecture and one three-hour laboratory and discussion. Harvesting as a production system including equipment, equipment mixes, costs and manpower in serving and logmaking and primary and secondary transportation. Evaluation of various systems as to environmental impacts. Wood as a raw material to the primary processing system and trees as inputs to the harvesting system. Spring.

FOR 378. New York Forestry .... (3)
Lecture, discussion, and field trip. Historical development of forests and forest uses in New York, analysis of current issues in New York forestry, and consideration of possible future developments for New York forests. Provides information useful to geographers, foresters, planners, and others interested in the social environment of New York's natural resources.

FOR 400. Forest and Resource Economics .... (3)
Three hours of lecture/discussion per week. This course examines the applications of principles and models of economics to planning and management of forest and related natural resources. Applications to timber, wildlife, water, and outdoor recreation are stressed. Market and nonmarket analyses are covered.
Prerequisite: Senior status in forest resource management, open to others with permission of the instructor.

FOR 404. Economics of Wood-Using Industries (3)
Three hours of lecture and discussion. Structure and organization of selected wood-using industries. Analysis of decisionmaking by the firm. Principles of production and marketing including demand and cost analysis and pricing. Special issues and current problems of the industries, and introduction to the newer mathematical and statistical tools for meeting them. Spring.
Prerequisite: Microeconomics.

FOR 405. World Forestry Resources: Problems and Prospects .... (3)
Three hours of lecture and discussion plus guided readings, pertaining to world forest resources and the problems and opportunities associated with their use and development. Major topics include: world forest resources; production and trade; principal wood-producing countries; forestry and the problems of underdevelopment; and special areas and topics of interest to world forestry. Spring.
Prerequisite: Senior status preferred.

FOR 433. Commodity Production Silviculture . (3)
Three hours per week of lecture and discussion stressing the development of prescriptions and the application of silvicultural techniques, primarily for commodity production. Topics include even-aged stand development, intermediate stand treatments, growth and change in uneven-aged stands, natural reproduction methods, assessing tree and stand quality and value, and application of selection system. Students undertake projects as a means for developing deeper understanding of and a capacity for prescribing different silvicultural techniques. Spring.
Prerequisites: FOR 334 and FOR 370, or equivalent. Senior standing required.

FOR 446. Forest Soil Classification, Survey, and Interpretation .... (3)
Three hours of lecture and discussion, one three-hour laboratory. Detailed examination of soil genesis and classification, and the survey and description of the soilscape. Interpretations are made for various land uses, especially forestry. Fall.
Prerequisites: FOR 331 or 345 or an introductory soils course.

FOR 450. Introduction of Environmental Impact... Analysis .... (2)
Two lecture periods per week. The legal history, context, interpretation, and offspring of the National Environmental Policy Act (NEPA) of 1969; scientific considerations of environmental impact analysis; scope of environmental impact, and alternatives to the NEPA procedures.

FOR 455. Forest Tree Improvement .... (3)
Two hours of lecture, three hours of lab or field work. General principles and methods of tree improvement practiced in this country and abroad. Tree selection, techniques of vegetative propagation, hybridization, polyploidy, establishment of seed orchards, clonal and offspring testing and other problems. Spring.
Prerequisite: EFB 307 or introductory courses in Mendelian or population genetics.

FOR 465. Natural Resources and Environmental Policy ..... (3)
Three hours per week of lecture and discussion. Course examines the working principles creating the structure of natural resource and environmental policy. Specific laws and policies are analyzed as a product of complex history of policy processes spanning common law, legislation, administration, court decisions, local zoning, and economic relationships. Applies basic analytical skills to policy questions. Explores the relationship of the manager to policy processes. Required of seniors in Resources Management and of Environmental Studies students in the Policy and Management Study Area; open as an elective to other undergraduates.
Prerequisite: Senior status, one semester in both economics and U.S. government.

FOR 470. Management of the Forest Enterprise .... (3)
Two hours of lecture and one discussion/laboratory. This course is concerned with the management alternatives, both of a technical and social nature that are available in the planning for and the production of timber, recreation, wildlife, forage and water from the forest and with the criteria for choice to meet management objectives. Fall.

FOR 473. Planning and Development of Forest Recreation Areas .... (3)
Three hours of lectures or equivalent laboratory and assignments. Planning and designing forest recreation areas, structures, and facilities. Development of construction plans for camp and picnic sites, for waterfront areas and for trails. Emphasis is on the functional relationship between planning and design, management, and maintenance. Field trips required. Fall.
Prerequisite: FOR 372.

FOR 474. Commercial Recreation .... (3)
Three hours of lecture and discussion per week, plus one all-day field trip. Introduction to the role of the private sector in providing recreational facilities, programs, and services. Case studies of private recreation enterprises. Emphasis on the requirements for successful commercial recreation ventures. Fall.
Prerequisite: FOR 372 or equivalent.

FOR 475. Sociology and Psychology of Leisure Behavior ... (3)
Three hours of lecture and discussion. Introduction to theory and research findings dealing with the sociological and psychological aspects of leisure behavior; field work and lectures demonstrate applications, particularly with regard to leisure behavior. Spring.
Prerequisites: FOR 372, and an introductory course in sociology or psychology, or permission of the instructor.

FOR 477. Resource Policy and Management ....(3)
Three hours of lecture supplemented by one hour of discussion and/or lecture. Public and private forest policy formation; principles of modern management; overall management and operation of a productive forest property. Primarily for forest engineers. Not available to Resource Management undergraduates. Fall.
Prerequisites: Mensuration and silviculture, senior standing in Forest Engineering, or by permission of the instructor.

FOR 478. Wilderness and River Recreation Management ...(3)
Three hours of lecture and discussion per week. Introduction to the federal and state legislation and institutional framework that affects wilderness and river recreation planning and management. Emphasizes dispersed recreation planning, site management, visitor management, carrying capacity, and wilderness and river recreation management plans. One two-day field trip required. Spring (odd years).
Prerequisite: FOR 372 or equivalent.

FOR 479. Outdoor Recreation Management ....(3)
Three hours of lecture per week. Descriptions of methods and techniques used in Outdoor Recreation Management. Discussion of practices of resource/visitor/services management. Spring.
Prerequisites: FOR 372, Fundamentals of Outdoor Recreation or equivalent, FOR 360, Principles of Management or equivalent.

FOR 480. Urban Forestry ....(3)
Two hours of lecture, and one hour of discussion or three hours of field study per week. Evaluation and management of urban greenspace resources, with emphasis on trees, in the context of other values and management processes in urban areas. Field practice in evaluating urban greenspace and tree resources. Shared resource course meeting with FOR 680 which has additional requirements. Spring.
Prerequisites: Senior status. FOR core courses or permission of the instructor for seniors in other programs.

FOR 496. Special Topics in Resource Management/Forestry .. ..(1-3)
Experimental and developmental courses in new areas of resource management/forestry or areas not covered in regularly scheduled courses. Topics may include but are not limted to the biological, physical, and social dimensions and the many and varied resources of forest lands and forestry. Specific detailed course descriptions for each course taught under the 496 designation are available for student perusal. Fall, Spring, and Summer.

FOR 498. Independent Study in Resource Management/Forestry....(1-6)
Independent research or study in resource management/forestry for selected undergraduate students. Selection of subject area, nature of the research or study, and number of credit hours determined by student in conference with appropriate faculty member; initiative in taking FOR 498 rests with the student. Final written report is required for record. Fall, Spring, and Summer.
Prerequisite: Cumulative G.P.A. of at least 2.50 and approval of the advisor and instructor.

FOR 499. Independent Study/Internship in Resource Management/Forestry ....(7-12)
Independent research or study in resource management/forestry for selected undergraduate students especially designed for internships spent off-campus working for a resource management or forestry oriented firm or organization while also pursuing an academically oriented project. The selection of the study topic will be determined by the student in consultation with his/her advisor. Guidance will be provided by a faculty committee. Final written report is required for record. Limited to seniors in resource management/forestry. Fall, Spring, Summer.
Prerequisite: Must have a cumulative G.P.A. of at least 3.00.

FOR 520. Application of Ecology..................(3)
Two hours of lecture and discussion and one to three hours seminar, workshop, or field trip. Exploration of use and implications of ecological concepts for practices modifying terrestrial ecosystems for human benefit. Discussion of ecological writings in relation to applied problems; workshops, field trips, and student presentations exploring ecological implications of specific situations. Course designed for interdisciplinry participation. Spring (even years).

FOR 523. Tropical Ecology ....(3)
One hour of lecture coupled with a period of intensive field study over spring break on a tropical island in the Caribbean. Principles of tropical ecology, resource management, and island biogeography are presented. Field trips to a variety of tropical ecosystems including: rain forest, coral reefs, crater lakes and montane rain forest. Comparisons with north temporate ecosystems are made. Additional fees required to cover cost of travel and lodging during field portion of course. Requires the ability to swim. Spring.
Prerequisite: EFB 320 or equivalent.

FOR 534. Greenspace Silviculture ....(3)
Two hours lecture; three hours field laboratory or two hours discussion per week. Concepts, techniques, and field practice of evaluating and managing vegetation systems, including site resources, woody and herbaceous vegetation, and use impacts, primarily for on-site, greenspace values on recreation, wildlife and multiple-use lands; ; roadsides and utility rights-of-way; buffer and protection areas, etc.. Fall.
Prerequisites: Graduate status and coursework in silviculture and soils. Qualified seniors by permission of the instructor.

FOR 535. Advanced Forest Soils ....(3)
Three hours of lecture-discussions concerning the current state-of-the-art in forest soils. Effect of intensive forest management on soil, soil-site-species relationships, forest fertilization tree nutrition. Application of forest soils information to silviculture. Spring.
Prerequisite: FOR 331, 332 or beginning courses in soils and silviculture.

FOR 536. Forest Planting ....(3)
Two hours lecture and three hours laboratory or field average per week, including up to two all-day field trips. Concepts and techniques of forest planting for land rehabilitation and as a silvicultural system;; including species and genetic selection, seed and plant production and evaluation, planting methods and site preparation, and regional case studies. Spring.
Prerequisites: Graduate status and coursework in silviculture. Qualified seniors by permission of the instructor.

FOR 540. Forest Hydrology ....(3)
Two hours of lecture and three hours of laboratory The relation of forest and range vegetation to its environment, and its effect upon soil and water. Measurement of precipitation, runoff, erosion, and other variables. Fall.

FOR 542. Practice of Watershed Management ....(3)
Two hours of lecture and three hours of laboratory. The impact of the multiple use of forest and range lands on water yield and soil stability. Regional problems and potential solutions. Fall.
Prerequisite: FOR 540.

FOR 561. Land Use Economics ....(3)
Three hours of lecture/discussion per week. Study of the theory and method of land use economics and the application of economic analysis to open space and regional planning. Emphasis is on understanding basic concepts, development of operational methods and data sources. Case studies, outside readings, and guest speakers are utilized. Spring.
Prerequisite: One course in microeconomics.

FOR 562. International Timber Trade ....(3)
Three hours of lecture. Basic principles of international trade. Structure and procedures of international timber trade. Major trade regions and their relationships. Economic context of timber trade. Emphasis is placed upon methods of analyses for understanding both opportunities and limitations of timber products exports and imports. Fall.

Prerequisites: Two semesters of undergraduate economics, and senior standing in forestry or wood products engineering.

FOR 588. The Law of Natural Resource Administration ....(3)
Three hours of lecture and discussion. An introduction to the law concerning the procedures, powers, and judicial review of public agencies responsible for the management of natural resources. Topics will include the extent of an agency's rule-making power and the rights of aggrieved parties to appeal from agency decisions. Spring.
Prerequisite: FOR 360 or equivalent course in public administration.

FOR 591. Oral Presentation Techniques ....(1)
Course meets one hour weekly for presentation and discussion. Course objective is improvement of presentation style and articulation skills through preparation, delivery, and interactive evaluation of information style seminars.
Prerequisite: Graduate standing and permission of the instructor.

FOR 592. Written and Oral Argumentation ....(2)
Course meets two hours weekly. Course objective is to improve articulation skills through effective argumentation. Students will participate in weekly discussions of the assigned readings, and each student will prepare, present, and support two position papers to a *review panel consisting of students and faculty within the class.*
Co- or Prerequisite: FOR 591 - Oral Presentation Techniques.

FOR 600. Field Applications in Forest Management and Operations ....(3)
Equivalent of three weeks of lectures, seminars, and field trips related to the management and utilization of the high value forest resources of the Allegheny Basin region. This course is the required entry point to the M.F. program and is taught during summer at the Allegany State Park near Salamanca, NY.
Prerequisite: Matriculation in the M.F. program - open to others by permission of the instructor.

FOR 601. Resource Information for Forest Management ....(3)
Three hours of lecture, discussion, or laboratory work per week. Introduces the student to the characterization of bio-physical and socioeconomic resources, their inventory and compilation into a geographic information system as an application of database management, and their evaluation and analysis for incorporation into the forest management decisionmaking process.
Prerequisite: Matriculation in the M.F. program - open to others by permission of the instructor.

FOR 602. Forest Resource Economics ....(3)
Three hours of lecture, discussion, or laboratory work per week. Provides students with analytical tools in forestry economics for analyzing and evaluating forest management operations. Provides an understand ing of the operation of the economic system within which forest resources are found.
Prerequisite: Matriculation in the M.F. program - open to others by permission of the instructor.

FOR 603. Advanced Silviculture ....(3)
Applications of basic principles and practices of silviculture within forest stands in accordance with and dictated by varying forest resource values and ownership objectives. Four hours of lecture and discussion per week for the first portion of semester, followed by six weekly hours of laboratory/field practicum thereafter. Field trips and lectures by guest experts. Several written and oral presentations required. Fall.
Prerequisite: Matriculation in the M.F. program - open to others by permission of the instructor.

FOR 604. Forest Policy ....(3)
Three hours per week of lecture, discussion, and recitation. Course content brings students to an advanced level of understanding of policies, the nature of issues, the institutional framework for policy evaluation. Emphasizes policy roles and functions in management, interrelationships, information resources, public input, and policy analysis for effective professional contributions in forest policy matters.
Prerequisite: Matriculation in the M.F. program - open to others by permission of the instructor.

FOR 605. Advanced Forest Management ....(3)
Equivalent of three credit hours per week of lecture and recitation. Provides students with the foundation necessary for the management and administration of a complex enterprise involving the use of forestland. Emphasizes the inherent multiresource nature of forest management; the diverse activities involved in producing outputs and services from forestland; and the managerial and technical skills required in planning, directing, and controlling those activities.
Prerequisite: Matriculation in the M.F. program - open to others by permission of the instructor.

FOR 606. Human and Organizational Behavior ....(3)
Three hours per week of lecture and recitation. Provides advanced students with knowledge of the interactions of individuals within organizational settings. Emphasizes the interdependency of people and organizational structures and requirements, and the role of management in facilitating harmonious mutual goal achievement. Deals with the nature and meaning of work, motivation, individual performance, job satisfaction, informal organizations, work environment, reward systems, controls, work stress.
Prerequisite: Matriculation in the M.F. program - open to others by permission of the instructor. Prior basic course in management principles highly desired.

FOR 610. Field Applications in Integrated Forest Management ....(3)
Three weeks of field trips, discussions, and problem analyses, and definition of problems associated with the implementation of decisions for operating forest systems in the Northeastern United States. Provides an intregation and field application of material in the Master of Forestry degree program. Concerned with the role of biological, physical, and social systems in management and planning. Summer.
Prerequisite: Matriculation in the M.F. program, open to others by permission of the instructor.

FOR 620. Silviculture Concepts and Applications. ....(3)
Three hours per week of lecture and discussion stressing the conceptual basis for developing prescriptions and applying silvicultural techniques, primarily for commodity production. Topics include even-aged stand development, intermediate stand treatments, growth and change in uneven-aged stands, natural reproduction methods, assessing tree and stand quality and value, and application of selection system. Students undertake independent research projects as a means for developing deeper understanding of silvicultural concepts, and to improve their capacity for prescribing different silvicultural techniques. Spring.

FOR 625. Productivity of Forest Stands ....(3)
In two hours of lecture and three hours of laboratory, whole tree, stand, and forest community productivity are studied from an ecophysiologicalviewpoint. Quantitative techniques and methods used to evaluate biological as well as economic forest production are learned and utilized. From the perspective established, new trends and developments in silvicultural practice are critically examined. Spring.
Prerequisite: Permission of the instructor.

FOR 630. Tropical Forest Ecology and Land Use(2)
Two hours of lecture and discussion per week. Tropical forest environments and associated vegetation are studied from an ecological perspective and development options evaluated:

agriculture, natural forest and plantation management, agroforestry, pasturing livestock, and forest preservation. Fall (even years).

Prerequisites: Coursework in ecology, soils, and silviculture is recommended, but not required.

FOR 635. Forest Soils and Their Analyses .... (3)
One hour of lecture, one hour of recitation, four hours of field and laboratory study of forest soils, emphasizing plant-soil relationships. Stress on quantification of plant-soil diagnostic techniques and their interpretation. Spring (odd years).

Prerequisites: FOR 446; background in physical and biological recommended.

FOR 640. Advanced Wildland Hydrology .... (3)
Lecture, discussion, and laboratory sessions in advanced problems of forest and range hydrology, watershed management methods, and techniques and evaluation of new methods of hydrologic data collection and analysis. Fall.

Prerequisite: SIL 540 or FEG 340.

FOR 641. Watershed Hydrology and Water Quality .... (3)
Three hours of lecture in classroom and field. Basic principles of watershed hydrology, natural water quality, and interactions between rural lands' management practices and water quality, especially, the substantive basis underlying and Best Management Practices for application of agricultural and silvicultural nonpoint sources on rural lands.

Prerequisite: Permission of the instructor.

FOR 642. Snow Hydrology .... (3)
Three one-hour lectures and two three-day field trips. Physical characteristics of snow and the energy relations important in its accumulation and dissipation. Problems of measurement and prediction of runoff and melt. Potentials for management. Spring.

Prerequisite: SIL 540 or FEG 340.

FOR 650. Environmental Impact Analysis Practicum .... (3)
Two discussion-workshop sessions per week. Team project and case study examination of the art of the environmental impact statement process, and consultant team operations and ethics.

FOR 655. Advanced Forest Tree Improvement .... (3)
Two hours of lecture and discussion and three hours of laboratory. A study of advanced principles and techniques for genetic improvement of forest trees. Special emphasis is placed on selection and breeding for growth rates, wood quality, and insect and disease resistance. Problems of tree hybridization, racial variations, sexual reproduction, and quantitative genetics in forest trees. Laboratory training in pollen germination, vegetative propagation and other problems. Independent research problems will be undertaken by the student. Fall.

Prerequisites: FBL 470 and 471, FOR 455.

FOR 664. Soil and Water Conservation Policy .... (3)
One three-hour meeting per week. An integrated, historical survey of water and related land resource conservation in the United States. Interrelationships of governments and private organizations in their functions of policy-setting and planning, administration of programs, and evaluation of projects. Fall.

FOR 665. Natural Resources and Environmental Policy ..... (3)
Three hours per week of lecture and discussion. Course examines the working principles creating the structure of natural resource and environmental policy. Specific laws and policies are analyzed as a product of complex history of policy processes spanning common law, legislation, administration, court decisions, local zoning, and economic relationships. Applies basic analytical skills to policy questions. Explores the relationship of the manager to policy processes. Shares lecture with FOR 465, but has a separate discussion/seminar section and requires more in-depth readings and a policy analysis paper of a selected topic.

Prerequisite: Graduate status, one semester in both economics and U.S. government.

FOR 670. Resource Economics .... (3)
Three hours of lecture and discussion per week. Economic theory and analysis in resource management and use decisions. Study and application of economic models to land, water, forest, wildlife and recreational resources. Relationships and interactions of public and private sector in resource management. Fall.

Prerequisites: Two semester courses of undergraduate economics.

FOR 671. Economics of Nonmarket Goods .... (3)
Group discussion, lectures, guided readings, case studies, and student projects on the economic aspects of watershed management, fish and wildlife management, and outdoor recreation. Major topics include theories of valuation and application to nonmarket goods, cost analysis for nonmarket goods, and techniques for valuing nonmarket goods and services.

Prerequisites: FOR 670 or microeconomics or permission of the instructor.

FOR 672. Open Space Planning .... (3)
Three hours of lecture and discussion; one overnight field trip required. Study of methods and techniques applicable to open space planning in nonurban areas. Survey of literature and current research. Open space standards, classification systems, and inventory methods. Development of plans for large scale recreational areas, and inclusion of recreation into regional plans. The interrelationship and conflicts between resource utilization/development and recreation/aesthetics reviewed through case studies. Fall (odd years).

FOR 674. Commercial Recreation .... (3)
Three hours of lecture and discussion per week, plus one all-day field trip. Provides an overview of the private sector recreational facilities, programs, and services. Reviews the requirements for successful commercial recreation ventures. Quantitative analysis related to business feasibility is emphasized. Fall.

Prerequisite: FOR 372 or equivalent.

FOR 675. Psychology of Leisure Behavior .... (3)
Three hours of lecture and discussion. Introduction to theory and research findings dealing with the sociological and psychological of leisure behavior: field work and lectures demonstrate applications, particularly in outdoor recreation. Fall.

FOR 676. Regional Development and Tourism ..(3)
Three hours of lecture/discussion per week. Study of the basic concepts of tourism as an important economic and social activity, and its place in regional resource development plans. Overnight field trip required. Fall.

Prerequisite: Permission of the instructor.

FOR 678. Wilderness and River Recreation Management .... (3)
Three hours of lecture and discussion per week. Reviews the institutional framework that affects wilderness and river recreation planning and management. Emphasis is on understanding management appropriate for dispersed recreational areas in forest and river environments and how planners and managers can use related research information. One two-day field trip required. Spring (odd years).

Prerequisite: FOR 372 or equivalent

FOR 679. Outdoor Recreation Management .... (3)
Three hours of lectures per week. Methods and practices of outdoor recreation management. Spring.

Prerequisites: One course in recreation, one in management or permission of the instructor.

FOR 680. Urban Forestry.............................. (3)
Two hours of lecture, and one hour of discussion or three hours of field study per week. Evaluation and management of urban greenspace resources, with emphasis on trees, in the context of other values and management processes in urban areas. Field practice in evaluating urban greenspace and tree resources. Shared resource course meeting with FOR 480, with

additional requirements for FOR 680. Spring.
Prerequisites: Permission of the instructor.

FOR 691. Research and Evaluation Techniques in Recreation .... (2)
Two hours of lecture and discussion per week. An introduction to the design of research and evaluation projects to assist recreation planning and management in the public and private sectors. Emphasis is on understanding the process of design, measurement, and analysis to achieve effective techniques and applications in recreation. Spring (even years).
Prerequisite: Graduate status and previous recreation courses.

FOR 696. Special Topics in Forestry .... (1-3)
Experimental and developmental courses in new areas of forestry not covered in regularly scheduled courses. A course syllabus will be available to students and faculty advisors prior to registration.

FOR 697. Seminar .... (1)
Group discussion and individual conference concerning current topics, trends, and research in management. Fall and Spring.

FOR 735. Forest Soil Fertility (Applied Studies) .... (2-4)
Two hours of lecture and one hour of discussion. Up to six hours of laboratory depending on number of credit hours. Influence of soil fertility on development and growth of seedlings and trees, and techniques involved to determine this influence. Chemical and biological analysis to determine levels of soil fertility. Nutrient element deficiencies and their correction by soil amendments and fertilizers. Term projects by the student will be undertaken. Spring (even years).
Prerequisites: CHE 332 and 333, FBO 530, FOR 446 and FOR 635, or equivalent.

FOR 751. World Forestry .... (3)
Three hours of lecture and discussion. Worldwide forest classification and geographic distribution; comparative study of forest policies and management systems; tropical forestry and deforestation; agroforestry; international timber trade; forest resources and economic development; technology transfers; United States' role in less developed countries' forestry. Spring.

FOR 753. Advanced Natural Resource and Environmental Policy .... (3)
Three hours per week of lecture and discussion. Course takes a social history approach to examine the working principles forming the foundation for natural resource and environmental policies. These principles will be directed toward an appreciation of the institutional context for the domestic and global natural resource and environmental issues, and an understanding of the values, institutions, policies, and rules which govern societies and their relationship to their environment.
Prerequisite: Graduate status, highly desired is previous coursework in public policy, natural resource or environmental policy, environmental law, public administration, or property law. For Continuing Education students, experience in public policy, environmental regulation, or government is desirable.

FOR 754. Advanced Forest Administration .... (3)
Critical appraisal of existing public, semipublic and private forest agencies in the United States, and the comparative study of major administrative organizations and practices. Occasional inspection trips to forestry headquarters and field units and discussion of internal administrative problems with forest officers. Fall or Spring.
Prerequisite: FOR 360 or equivalent.

FOR 796. Special Topics in Forest Resources Management .... (1-3)
Lectures, seminars, and discussion. Advanced topics in resource management and policy. Check schedule of classes for details of subject matter. Fall and/or Spring.

FOR 797. Seminar .... (1)
Individual presentation and group discussion concerning current topics of concern to natural resources or their management. Fall and Spring.

FOR 798. Research Problems in Forestry .... (1-6)
Special investigation and analysis of forest resource management topics. A study plan and a final written report are required. Fall and Spring.

FOR 895. Graduate Internship .... (1-6)
Professional experience which applies, enriches, or complements formal coursework. Restricted to Graduate students in Forest Resource Management. Graded on an "S/U" basis. Fall, Spring, and Summer.

FOR 898. Professional Experience .... (6-12)
Professional experience which applies, enriches, or complements formal coursework. Restricted to M.S. students in Option 2. Graded on an "S/U" basis. Fall, Spring, and Summer.

FOR 899. Master's Thesis or Project .... (1-6)
Investigation leading to the completion of a research-oriented thesis or to an application-oriented project. Graded on an "S/U" basis. Fall, Spring, and Summer.

FOR 999. Doctoral Thesis Research .... (1-12)
Investigation leading to the completion of the doctoral thesis. Graded on an "S/U" basis. Fall, Spring, and Summer.

FTC—FOREST TECHNOLOGY

FTC 200. Dendrology I .... (2)
Twenty-five hours of lecture and 34 hours of field time. A study of the distinguishing characteristics, growth features, distribution, associates and importance of the major tree species of North America. Seasonal field identification and on-the-spot discussion of habitats, associates, and the place in succession of the predominant forest trees and shrubs as found in the Adirondack area of the Northeast, plus a limited number of introduced species. Fall.

FTC 202. Plane Surveying I .... (5)
Sixty-six hours of lecture and 132 hours of field and laboratory time. An introduction to the theory and practice of plane surveying. Emphasis is on individual skill development through small crew projects, handling typical surveying equipment in typical field situations. Lecture topics include the theory of measurements and errors, mathematics for plane surveying, introduction to field problems and introduction to map use and preparation, United States Public Land Survey System, and concepts of deed descriptions and record keeping procedures. A trip to the County Court House is scheduled for a tour of the Record Room. Field projects include traversing, using forester's and engineer's tools and methods, mapping using field and office methods, and proficiency projects in handling typical surveying instruments. Fall.

FTC 204. Forest Mensuration and Statistics I .... (3-1/2)
Sixty-nine hours of lecture and 46 hours of field and laboratory time. A classroom and field study of the basic principles and skills required for timber measurements. Volume tables, their use and construction, are studied. Cruise reports are required in which the student presents cruise results. Various methods of forest sampling are studied, including methods of calculating necessary sampling intensities and sampling errors. Fall.

FTC 205. Forest Mensuration and Statistics II .... (2)
Four hours of lecture and 60 hours of field and laboratory time. A field problem of practical nature utilizing methods for collecting, analyzing, and presenting data dealing with timber volumes. Spring.
Prerequisite: FTC 204.

FTC 206. Forest Ecology .... (3)
Forty-eight hours of lecture and 52 hours of field time. Study of weather and weather data collection; students monitoring a forest weather station. Study of climate and soil factors, how they affect trees and forests and the interactions both within the forest community and within the forest ecosystem. Introduction to cover type mapping. Final field problem and written and oral report on the detailed analysis of a forest transect. Fall.

FTC 207. Aerial Photogrammetry .... (2)
Twenty-five hours of lecture and 44 hours of laboratory. Development of the ability to interpret important ground features by viewing aerial photos singly and in pairs, using stereoscopic techniques and equipment. Scale problems and the making of reliable horizontal and vertical measurements. Radial line plot control for the transfer of detail to base maps. Forest type mapping and forest mensuration using photos. Fall.

FTC 208. Allied Technologies .... (2)
Twenty-nine hours of lecture and 36 hours of laboratory time. This is a multi-subject course. It provides the student with technical competence in the proper use, design; construction and/or maintenance of forest hand tools, maps and route surveys, trail development and first aid and CPR. Fall.

FTC 209. Forest Roads .... (2)
Twenty-two hours of lecture and 34 hours of laboratory time. This course provides the student with the technical competence necessary to administer, locate, and design the construction and maintenance of a typical forest gravel road. Spring.
Prerequisite: FTC 202.

FTC 210. Computer Applications .... (1)
Ten hours of lecture and 20 hours of laboratory time. An introduction to the use of computers, including computer systems, disk operating systems, word processing, development and use of spreadsheets, development and use of a database, and computer applications in forestry and surveying. Fall.

FTC 211. Silviculture I .... (2-1/2)
Forty-one hours of lecture and 54 hours of laboratory. Lectures cover orientation, terminology and present a framework of the various treatments used in many common stand conditions to bring the forest into a more productive state in accord with the objectives of management. Emphasis on thinning in computer simulation and field practice. Exercises in planting and pruning. Demonstrations in chemical silviculture. Spring.
Prerequisite: FTC 206 Forest Ecology.

FTC 213. Forest Entomology .... (1)
Eighteen hours of lecture and 16 hours of laboratory/field time. A study of insects that damage trees and their role in the total forest community. The course covers identification of local forest insects, study of the major pest groups of other forest regions, and control measures including integrated pest management and pesticides. Fall.

FTC 214. Personnel Management .... (1-1/2)
Fourteen hours of lecture; 16 hours of laboratory time. A study of company and agency organization functions, including selection of and placement of personnel, training of personnel and performance evaluations, planning for and administering crew responsibilities, human relations in the working situation, and special personnel problems of the forest are covered. Techniques of foremanship are applied in various field exercises in other courses, along with the study of safety hazards, accident prevention, accident classification, and accident reporting. Spring.

FTC 215. Timber Harvesting .... (2)
Eighteen hours of lecture and 36 hours of field time. This course acquaints the student with the basic harvesting methods and techniques, with emphasis on the Northeast, along with the knowledge of how and where harvesting fits in with other forest uses. Students gain technical competence in timber sale contract administration and basic timber appraising. Spring.

FTC 217. Forest Management .... (3-1/2)
Thirty-seven hours of lecture and 68 hours of lab and field work blocked with silviculture. Coverage of the common problems met in organizing a forest property to approach the goals of ownership. Study and practice in techniques of growth measurement and the gathering and use of forest records in general. Review actual examples and case studies of forest management and production activities. Summary application of pertinent information from many other courses in a work plan involving management decisions for an assigned forest property. Spring.
Prerequisite: FTC 206.

FTC 218. Forest Recreation .... (1-1/2)
Fourteen hours of lecture and 32 hours of field/laboratory time. This course acquaints the student with the forest recreational resource, its present and future needs. Principles of recreational development and management are discussed with special emphasis placed on the technical aspects. Spring.

FTC 219. Elements of Wildlife Ecology .... (1-1/2)
Twenty-four hours of lecture and four hours of field time. A study of the principles of wildlife ecology with fundamentals related to the actions of the preservationist, conservationist, and particularly those of the forest manager. Spring.

FTC 221. Soil/Water Measurements and Control .... (1-1/2)
Fourteen hours of lecture and 28 hours of laboratory and field time. A basic introduction to precipitation and streamflow measurements taken at weather stations, snow courses, streamgaging stations, and other sample points. Includes field and lab measurements for determining physical properties of soils related to land management. Discusses forest management practices commonly used to control erosion and water quality. Spring.
Prerequisite: FTC 206 Forest Ecology.

FTC 223. Graphics .... (1)
Sixteen hours of lecture. An introduction to lettering and drafting with emphasis on the skills needed by the forest or surveying technician. Individual skill development is achieved through several projects. The concept behind each project is explained in handout material and lecture, and each student is then expected to complete the project on his/her own time. Freehand and mechanical lettering plates are produced in addition to precision and map drawings. Fall.

FTC 226. Forest Pathology .... (1)
Twenty hours of lecture and 16 hours of laboratory/field time. A study of forest and shade tree diseases, disease identification, disease classification, economic and ecological impacts of diseases, and the role of diseases in the forest community. Fall.

FTC 227. Fire Management .... (2)
Twenty-seven hours of lecture and 16 hours of laboratory/field time. The basic principles of fire ecology, forest fire behavior, fire danger and fire danger rating, forest fire prevention and control, and prescribed burning are covered. Fire behavior and fire danger rating are calculated using computers. Handtool fire suppression techniques are practiced and demonstrated. Spring.

FTC 228. Structure and Growth of Trees .... (1-1/2)
Seventeen hours of lecture and 12 hours of laboratory. A study of the various tissues of forest trees and how their growth and development are affected by internal and external factors. Differences in stem structures of some of the more important commercial tree species of the U.S. are studied in the laboratory and these differences are related to the commercial uses of these species. Spring.
Prerequisite: An introductory course in general botany or biology.

FTC 229. Silviculture II ....(2)
Twenty-six hours of lecture and 28 hours of field and laboratory. Continuation of FTC 211 dealing mainly with the handling of the more complex hardwood and mixed stands common to the Northeast. Special coverages will be offered on current practices of regional importance beyond the Northeast where graduates are likely to be employed. Spring.

FTC 230. Plane Surveying III ....(2)
Twenty-six hours of lecture and 28 hours of field time. A continuation of FTC 202 and FTC 203 with emphasis on small crew projects using the theodolite. Advanced field techniques are discussed and practiced, such as the determination of the true-meridian by the method of direct solar observation, layout of highway curves and simple triangulation procedures. Each topic is developed in detail in the classroom before each field project is completed. Spring.
Prerequisites: FTC 202 and FTC 203.

FTC 298. Independent Study in Forest Technology ....(1-6)
Independent study in forest technology to apply, enhance, or supplement forest technology or related natural resource education. Objectives and scope of the project are negotiated in a learning contract between the student and instructor(s), with course admission based on permission of the instructor(s). Limited to those who have attended the complete regular SFT program, or those who have graduated from another forest technology program or a related natural resource program, or to students enrolled in any ESF program other than than of the SFT. A maximum of 6 credit hours may be taken by any student in total. Semesters as arranged. Fall, Spring, or Summer.

LIB - LIBRARY (COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY COURSE)

LIB 300. Library Research ....(1)
Fifteen hours of class time per semester (usually the first five weeks). Introduction for students at all levels to basic library material and the research process leading to preparation of a bibliography. Fall and Spring.

LSA—LANDSCAPE ARCHITECTURE

(See also courses listed under EIN and CMN.)

LSA 320. Introduction to Landscape Architecture and Planning.................................(3)
Three hours of lecture. The course presents an overview of the professions of landscape architecture and planning. It surveys the historic and contemporary situations of environmental design and planning. The course introduces the sociocultural and natural factors which influence the form and condition of the physical environment. It will introduce issues, personality, and projects. Fall.

LSA 326. Landscape Architecture Design Studio I ....(3)
Six hours of studio and one hour of lecture. The first in a sequence of studios focusing on the concepts, skills, and methods of design. This course introduces students to the basic vocabulary, concepts, and principles of design; the application and operation of these in the physical environment, development of three-dimensional spatial concepts. The requirements for this course include readings, examinations, field trips, design exercises, and projects. (Student field trip expense $125-$150.) Fall.
Prerequisite: Permission of the instructor.

LSA 327. Landscape Design Studio II ....(3)
One hour of lecture and six hours of studio. The second in a sequence of studios focusing on the concepts, skills, and methods of design. This course continues the development of design abilities through study of the interrelationship between the requirements of a design established in a program, the visual character of the site and the development of a designed result. The development of spatial concepts which meet principles of composition organization and a given set of requirements. The requirements for this course include readings, examinations, field trips, design exercises, and projects. (Student field trip expense $125-$150.) Spring.
Prerequisites: LSA 326, with a minimum grade of C, and CMN 382.

LSA 330. Site Research and Analysis ....(3)
One hour of lecture and three hours of studio per week. This course will require those enrolled to apply principles of natural resources and processes to assess the land use and development potentials and limitation of a site. The principles will include landforms, soils, hydrology, climate, energy, and plant, animal and human ecology. A variety of manual and computer techniques for data collection, analysis and synthesis of natural systems information will be explored. The course will concentrate on the comparison of synthesis techniques and their implications for land use and design decisionmaking. Occasional local field trips will be utilized. Spring.
Prerequisite: LSA 411 or permission of the instructor.

LSA 411. Natural Processes in Planning and Design ....(3)
Two hours and forty minutes of lecture per week. An overview of basic principles and processes of physical and biological landscape systems with respect to their roles in landscape design and planning. Emphasizes landform, soil, slope, hydrology, climate, energy, and general ecological issues as common elements influencing landscape design and the land use decisionmaking process. Sources and uses of environmental data are discussed. Fall.

LSA 422. Landscape Design Studio III ....(4)
Twelve hours of studio. This course is a continuation of skill development, theory, and strategies as they relate to design issues and process. Emphasis is placed on in-depth investigation on projects of a direct scale illustrating form derivation and the man-made and natural form. Occasional field trips to illustrate various design solution. Fall.
Prerequisites: LSA 327, with a minimum grade of C, and LSA 330.

LSA 423. Landscape Design Studio IV............(4)
Twelve hours of studio. This course emphasizes skill development, theory, and strategy as they relate to large-scale site design situations. Continues prior courses' emphasis on design process and form manipulation. Occasional field trips to illustrate and inspect design form. Spring.
Prerequisite: LSA 422, with a minimum grade of C.

LSA 425. Orientation for Experiential Studio ....(2)
Three hours of lecture and recitation. Investigation and documentation of an area of specialty, discussion, readings, and research. Fall and Spring.
Prerequisite: Permission of the instructor.

LSA 433. Plant Materials ....(2)
Three hours of lecture and field work for first one-third of semester. Two hours of lecture for second one-third of semester. This course concentrates on woody plant materials used in landscape architecture, the ecological relationships of plants, ornamental plant materials use and identification, plant culture propagation, transplanting, planting plans and specifications. Fall.
Prerequisite: Permission of the instructor.

LSA 434. Design Materials...................................(1)
Three hours of lecture for last one-third of a semester. An introduction to wood, concrete, masonry, asphalt, stone, and synthetic materials intended to provide students with an understanding of the basic visual, structural, and maintenance principles of each, in order to both use the materials in design and prepare written specifications. Fall.

LSA 442. Site Grading ....(2)
Two hours of lecture and three hours of studio during first two-thirds of semester. Lectures, projects, and assigned readings. The study of grading as the primary means of landform

modification in landscape architectural design. Primary emphasis will be given to principles of grading, including contour manipulation, sections, profiles, and computations. Concepts of establishing acceptable slopes and positive surface drainage will be introduced. Enrollment limited to BLA or MLA students. Fall.
Prerequisite: LSA 330, Site Research and Analysis.

LSA 443. Site Drainage Systems ....(1)
Three hours of lecture for last one-third of semester. Lectures, projects, and assigned readings. Provides a basis for the design of drainage systems. Coverage includes concepts relevant to understanding precipitation, methods of run-off quantification, open channel flow, systematic pipe network analysis. Enrollment limited to BLA or MLA students. Fall.
Prerequisite: LSA 330, Site Research and Analysis.

LSA 444. Vehicular Circulation Design ....(1)
Three hours of lecture for first one-third of semester. Lectures, projects, and assigned readings. Must be taken concurrently with LSA 423. Introduces the circular geometry of horizontal curves and the parabolic geometry of vertical curves, curve coordination based on safety and aesthetic relationships, road grading. Enrollment limited to BLA or MLA students. Spring.
Prerequisites: Computer programming and surveying.

LSA 445. Elements of Structures ....(1)
Three hours of lecture during the second one-third of the semester. Lectures, projects, and examinations. An introduction to the concepts of assembling engineering materials into structure. All common building systems will be surveyed and emphasis will be placed on fundamentals rather than on detailed mathematical design procedures.
Prerequisite: Non-Faculty of Landscape Architecture students by permission of the instructor. Not open to engineering majors. Spring.

LSA 451. Comprehensive Land Planning ....(3)
Three hours of lecture per week. Introduction to the planning process including survey and analysis techniques, the comprehensive plan, political context, and land use controls. Selected functional planning areas such as land use, environmental, growth management, regional planning, and economic development planning. Legal and historical basis.
Prerequisite: LSA 411 or permission of the instructor.

LSA 453. Community Land Planning Workshop . (4)
Land use and environmentally related planning issues explored through a case study including surveys, analyses, plan preparation, development of implementation strategies, and report preparation.
Prerequisites: LSA 411 and 451 or permission of the instructor.

LSA 455. Professional Practice in Landscape Architecture . (2)
Two hours of lecture. This course examines the historic and contemporary modes of landscape architectural practice including practice types, ethics, operations, and client systems. Particular emphasis is given to the projected trends of professional practice and with impact on future roles for the landscape architect. Professional development is reviewed as it relates to internship, licensing, and continuing education. Occasional field trips will be utilized. Spring.
Prerequisite: Senior status in landscape architecture or permission of the instructor.

LSA 495. Selected Readings in Environmental Studies ... (1-3)
Exploration of selected readings in depth with individual independent study upon a plan submitted by the student and related to credit hours assigned. Upon approval of the instructor, the student may systematically investigate some subject area encountered in regularly scheduled courses or may initiate research on a variety of subject areas of determined relevance. Fall and Spring.
Prerequisite: Permission of the instructor.

LSA 496. Special Topics in Landscape Architecture ....(1-3)
One to three hours of class meetings. Special topics of current interest to undergraduate students in landscape architecture and related fields. A detailed course subject description will be presented as a topic areas is identified and developed. Fall and Spring.
Prerequisite: Permission of the instructor.

LSA 498. Introductory Research Problem ....(1-3)
Guided study of a selection of problems relating to landscape architecture and environmental design. Emphasis on study procedure and methods employed. Enrollment at periodic intervals throughout the semester. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor.

LSA 522. Landscape Design Studio VI ....(4)
Twelve hours of studio. Studio problems, research, drafting and field trips. Concentration on complex urban problems. Concern for social and psychological considerations of the individual and large groups of people, their interaction and resultant forms of the environment. Spring.
Prerequisite: Permission of the instructor.

LSA 524. Experiential Landscape Studio Design ....(16)
Forty-eight hours per week. The articulation of the study proposal established in LSA 425, as approved by faculty, through research, readings, field study with graphic and written documentation, and group discussion. Academic study in an off-campus location in an area of landscape architectural significance, as described and delineated in a student-prepared proposal approved by the faculty. Fall or Spring.
Prerequisites: LSA 425 and LSA 423, with a minimum grade of C.

LSA 525. Landscape Design Studio VI ....(4)
Twelve hours of studio. Investigation of a problem in landscape architecture as proposed by the student and conducted in conjunction with faculty advisor. Spring.
Prerequisite: Permission of the instructor.

LSA 527. Landscape Design Studio VI............(4)
Twelve hours of studio. Studio problems, research, reports, and field trips. Concentration on regional landscape problems, the techniques of their analysis and derivation of their significance to the practice of landscape design. Spring.
Prerequisite: Permission of the instructor.

LSA 533. Plant Materials............................(2)
Field trips and discussion. Ornamental woody plant identification. Observation and sketches of outstanding examples of planting design. Two weeks. Summer.
Prerequisite: Permission of the instructor.

LSA 545. Professional Practice Studio ....(3)
Six hours of studio, one hour of recitation per week. Studio problems, research, discussion and recitation sessions on the processes and methods of office practice. Emphasis on all aspects of site development. Spring.
Prerequisite: Permission of the instructor.

LSA 595. Selected Readings in Landscape Architecture . (1-3)
Exploration of selected readings in depth with individual independent study upon a plan submitted by the student and related to credit hours assigned. Upon approval of the instructor, the student may systematically investigate some subject area encountered in regularly scheduled courses or may initiate research on a variety of subject areas of determined relevance. Fall or Spring.
Prerequisite: Fifth-year status or permission of the instructor.

LSA 596. Special Topics in Landscape Architecture ......(1-3)
Experimental or special coursework in landscape architecture for graduate and undergraduate students. Subject matter and method of presentation vary from semester to semester. Fall

and Spring.
Prerequisite: Permission of the instructor.

LSA 598. Research Problem .... (1-3)
Independent study of selected areas of environmental interest. Emphasis on a self-disciplined study, development of procedures and techniques to be employed in environmental design and planning. Engagement with specific sites and problems as proposed for study by individual communities. Enrollment at periodic intervals throughout the semester. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor.

LSA 600. Design Studio I .... (4)
Nine hours of studio and one hour of lecture/discussion per week. The first in a sequence of studios focusing on the concepts, skills, and methods of design. This course introduces students to the basic vocabulary of theoretical design principles, to the application and operation of these in the physical environment, and to the development of three-dimensional spatial concepts in community scale patterns. The requirements for the coarse include readings, examinations, field trips, design exercises, and projects. Fall.
Prerequisite: MLA status or permission of the instructor.

LSA 601. Design Studio II .... (4)
Five hours of studio and one hour of lecture per week. The second in a sequence of studios applying the concepts, skills, and methods of design in a critical analysis of various natural and human systems in community scale environments. Concentration is on the evaluation of options concerning a variety of land use activities, with special emphasis on landscape analysis and the functional and spatial quality of built environments. The requirements for this course include readings, examinations, field trips, design exercises, and projects. Spring.
Prerequisites: MLA status and LSA 600, CMN 552, or permission of the instructor.

LSA 611. Natural Factors Analysis .... (3)
Two hours and forty minutes of lecture and one hour of discussion per week. This course addresses basic principles and processes of physical landscape systems with respect to their roles in landscape design and planning. Sources and uses of environmental data are discussed and illustrated. An emphasis is placed on landform, soil, slope, hydrology, climate, and general ecological issues as common elements influencing landscape design and the land use decisionmaking process. Fall.
Prerequisite: MLA status or consent of the instructor.

LSA 615. Site Construction Grading, Drainage and Road Layout .... (3)
One hour of lecture and six hours of studio per week. This course provides an introduction to important site construction basics, including landscape grading and landform manipulation to achieve appropriate slopes for use and positive surface drainage, principles of cut/fill analysis and subsurface drainage, horizontal and vertical alignment for road design, storm water management, and soil erosion control. Appropriate analysis methods and technologies will be employed through studio projects and exercises. Spring.
Prerequisite: MLA status, concurrent enrollment in LSA 601 or consent of the instructor.

LSA 620. Design Studio III—Advance Site Design .... (4)
One hour of lecture and nine hours of studio per week. This course is the third in a sequence of landscape architectural design studios. It focuses on advanced issues in site design and on the integration of project programming and design development into the design process. Concentrations include detailed designing for site layout, grading, storm water management, interior and exterior planting, site furnishing, and site lighting. Design exploration and project communication techniques are pursued such as CAD, reprographics, and computer-based visual simulation. Course requirements include readings, field trips, exercises, and design projects. Fall.
Prerequisites: MLA status, LSA 601, LSA 611, LSA 615, or consent of the instructor.

LSA 621. Design Studio IV- Community Design and Planning .... (4)
Nine hours of studio and one-hour of lecture/discussion per week. Design studio problems addressing principles and practice of community design, the structure and language of human settlements, community design process, natural systems and community design, and an introduction to the history, traditions and literature of the field. Spring.
Prerequisite: LSA 620 or consent of the instructor.

LSA 640. Research Methodology .... (3)
Three hours of lecture and discussion per week. This course focuses on the application of scholarly and scientific methodology to the activity of intellectual inquiry. The purpose is to enable students to identify researchable questions and introduce the methodology necessary to answer these questions in an unambiguous and objective manner. The course addresses issues of theory, research organization, experimental design, sampling theory, data manipulation, and communication with respect to proposals, projects, theses, and technical papers. Spring.
Prerequisite: Graduate standing or consent of the instructor.

LSA 650. Behavioral Factors of Community Design .... (3)
Three hours of lecture and discussion. An introduction to the contribution of the behavioral sciences to community design and planning is provided. Readings and discussions concern both theoretical and methodological aspects. Case studies are used to illustrate a variety of current behavioral science applications. Course assignments to familiarize the student with basic behavioral science methods including questionnaires, observations, and interviews. A final project provides an opportunity to synthesize course materials. Fall or Spring.
Prerequisite: MLA status or permission of the instructor.

LSA 652. Community Development and Planning Process .. (3)
Three hours of lecture per week. This course introduces planning and community development as connected, interdependent processes. Community dynamics, the participants in the planning and development processes, theories, principles and practices, and the role of design, will be explored. Lectures, seminars, guest speakers, research projects, readings, and discussion will be used to engage the course material. Fall.

LSA 653. Visual Landscape Analysis .... (2-3)
Three hours of lecture and discussion weekly during the first three quarters of the semester will cover aspects of landscape perception; introduction to methods of visual landscape inventory and evaluation, visibility determination, psychometric assessment, and visual impact assessment; and visual resource management strategies. Problems and exams will be required. Optional third credit entails four hours weekly of laboratory or field projects applying analysis methods and techniques during last quarter of semester.

LSA 654. Ecology in Landscape Design and Planning .... (3)
Three hours of lecture and discussion per week, with some Saturday field trips required. This course addresses methods of describing vegetative patterns in the landscape, emphasizing the processes that produce these patterns and the interactions that cause them to change. Familiarization with natural and cultural plant communities and the species that dominate their composition. The purpose is to identify the major biotic components that shape the ecological landscape, and relate them to pragmatic issues of land use, vegetation management, and landscape design. Fall.
Prerequisites: LSA 433, or LSA 533, or EFB 320, or EFB 578, or a dendrology course, or consent of the instructor.

LSA 655. Professional Practice for MLAs .... (4)
Two hours of lecture and six hours of studio per week. This course provides an overview of contemporary professional practice in public and private sectors, including steps in project implementation, familiarization with project management, marketing techniques, professional standards/conduct/registration, liability and ethics. Students will complete a set of typical construc-

tion documents in this course. Spring.

Prerequisite: MLA status or consent of the instructor.

LSA 656. Visual Landscape Simulation ....(3)
Two hours of lecture and discussion and three hours of workshop per week. An introduction to the theory and principles of creating visual landscape simulations. Students will develop skill in digital photography techniques and apply them to an assigned project. Fall or Spring.

LSA 671. History of Landscape Architecture ....(3)
Three hours of lecture-seminar. Regular use of slides and other projected lecture material; assigned texts as a basis for lecture; supplemental readings, assigned and individually researched; class discussion from readings and lecture; and student presentations and term paper. Historical study and style analysis of Western man's efforts to design his environment and his changing attitudes and relationships to environment. Also, non-Western coverage where significant or influential on Western man. Study of historical personalities as well as periods that are of environmental concern up into the modern periods. Fall.

Prerequisite: MLA standing or permission of the instructor.

LSA 696. Special Topics in Landscape Architecture ......(1-3)
Experimental or special coursework in landscape architecture for graduate and undergraduate students. Subject matter and method of presentation vary from semester to semester. Fall and Spring.

Prerequisite: Permission of the instructor.

LSA 697. Topics and Issues of Landscape Architecture ....(1)
Two hours of lecture and discussion every other week. Topics for discussion are selected to acquaint the entering graduate student with a generalized view and current issues facing landscape architects. Students are required to audit LSA 320 concurrently. Fall.

Prerequisite: MLA students or permission of the instructor.

LSA 699. Landscape Architecture Internship ....(1-12)
Internships provide students with a supervised field experience to apply and extend their academic abilities in a professional working environment. Enrollment is possible at various times during the semester. Fall, Spring, and Summer.

Prerequisite: Fast Track BLA/MLA status and written approval of an internship contract by major professor, curriculum director, and field supervisor.

LSA 700. Design Studio V- Integrative Studio (4)
One hour of lecture and nine hours of studio per week. This studio requires the integration of design/planning processes, research methods and information, and technical skills through focus on large-scale, community-based or multicommunity-based projects. Studio work will require individual and team work, as well as consideration of multidisciplinary contributions and interdisciplinary work. This studio is the final studio for all MLA students. Fall.

Prerequisites: LSA 600/601, LSA 620/621 or permission of the instructors.

LSA 752. Urban and Regional System Dynamics ....(3)
Lectures and workshop. The major concerns of this course are application of system dynamics; basic principles of system dynamics; and system dynamics modeling. This method is investigated as a useful tool in modeling many landscape architectural and planning problems. No prior computer experience is necessary. Spring.

Prerequisite: Permission of the instructor.

LSA 796. Special Topics in Landscape Architecture ....(1-3)
One to three hours of class meetings. Special topics of current interest to graduate students in landscape architecture and related fields. A detailed course subject description will be presented as a topic area is identified and developed. Fall and Spring.

Prerequisite: Permission of the instructor.

LSA 798. Research Problem
(Credit hours to be arranged according to nature of problem)
Special study of assigned problems relating to landscape architecture or planning, with emphasis on critical thinking. Fall, Spring, and Summer.

Prerequisite: Permission of the instructor.

LSA 799. Thesis/Project (Internship) Proposal Development ....(1)
One hour of lecture/workshop per week. During this course, a student will prepare a proposal for a thesis/project in the MLA program. Spring or Fall.

Prerequisite: LSA 640 or permission of the instructor.

LSA 898. Professional Experience ....(1-12)
A supervised external professional work experience which satisfies Option 2 of the master's study integration requirement. Graded on an "P/F" basis. Fall, Spring, and Summer.

Prerequisite: Formation of committee, approval of proposed experience by committee, and the sponsor of the professional experience.

LSA 899. Master's Thesis Research (Credit hours to be arranged)
Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

PSE—PAPER SCIENCE AND ENGINEERING

PSE 300. Introduction to Papermaking ....(3)
Three hours of lecture. Historical and commercial consideration of the paper industry. Technology of papermaking with emphasis on stock furnish, stock preparation and paper machine operation. Introductory discussions of papermaking materials and formation and reactions of a fibrous web. Fall.

PSE 301. Pulp and Paper Processes ....(3)
Three hours of lecture. Technological consideration of pulping and bleaching of woody raw material. Includes consideration of wood procurement and preparation, pulping and bleaching processes, recovery of secondary fibers, pollution abatement and other ancillary operations. Spring.

Prerequisites: FCH 572, PSE 300 (or concurrent).

PSE 304. Mill Experience ....(2)
Twelve weeks full-time pulp or paper mill employment approved by the faculty between the junior and senior years. The student must submit a comprehensive report to fulfill this requirement. Summer.

PSE 361. Engineering Thermodynamics ....(3)
Principles of classical thermodynamics applied to engineering practice. First and second laws; heat effects; property functions and their correlation; physical and chemical equilibria; solutions and mixtures; power andrefrigeration cycles. Thermodynamic analysis of processes and systems via case studies and computer simulation.

Prerequisites: Physics, calculus, PSE 370 and FCH 360 or equivalent.

PSE 370. Principles of Mass and Energy Balance ....(3)
Three hours of lecture. Conservation of mass and energy applied to steady-state and dynamic process units and systems. Problem analysis and solution; computational techniques. Thermodynamic data and their use; real vs. perfect gases; steam properties; psychrometry. Fall.

Prerequisites: Calculus, physics, and FCH 360 (or concurrent).

PSE 371. Fluid Mechanics ....(3)
Three hours of lecture and/or demonstrations. The study of momentum transfer. Steady and unsteady flow of liquids and gases in pipelines, ducts, open channels, and porous media. Movement of particles in fluid media. Newtonian and non-Newtonian flow and flow of suspensions. Filtration, sedimentation, centrifugation, agitation and mixing. Characteristics and selection of pumps, blowers, agitators and other equipment. Flow measurement and flow system design with economic considerations. Fall.
Prerequisites: College level physics and chemistry, calculus.

PSE 372. Heat Transfer ....(3)
Two hours of lecture and/or demonstration. The study of heat transfer including conduction, convection, radiation and their applications in industry. Heater and heat exchanger design and selection, and industrial evaporation. Spring.
Prerequisites: PSE 370 and 371 or equivalent.

PSE 456. Management in the Paper Industry Lecture Format with Seminars ....(3)
Provides the student with interactive contact with active executives in the paper and allied industries. The student will develop and present studies of business cases in discussion forum to the class. An understanding of how general managers operate to manage an entire organization will be presented by visiting experts, class participation, group presentations, written papers, and examinations.

PSE 461. Pulping Technology ....(3)
One hour of lecture and six hours of laboratory. Discussion of pulping and bleaching processes: effect of chemical and physical variables on the wood components and pulp properties; chemistry involved. Experiments in pulping and bleaching, and pulp evaluation. Fall.
Prerequisites: PSE 301, FCH 360 and FCH 361 or equivalent.
Note: A student may not enroll in or receive credit for both PSE 461 and ERE 671.

PSE 465. Paper Properties..........................(4)
Three hours of lecture, three hours of laboratory and discussion. Evaluation and study of the physical, optical, and chemical properties of paper and the interrelationships existing between paper manufacturing methods, papermaking additives, test results and the ultimate properties desired in the finished paper. Fall.
Prerequisites: PSE 300 and PSE 301.
Note: A student may not enroll in or receive credit for both PSE 465 and ERE 677.

PSE 466. Paper Coating and Converting ....(2)
Two hours of lecture. Evaluation and study of various coating materials and processes used by the paper industry. Introduction to polymers and their use in converting operations. Study of materials and equipment used in converting operations, fundamentals and parameters which control their use, effects on final properties of papers. Spring.
Prerequisite: PSE 465.
Note: A student may not enroll in or receive credit for both PSE 466 and ERE 678.

PSE 467. Papermaking Wetend Chemistry ....(3)
Provides the student with the fundamental principles of Colloid and Surface Chemistry as they relate to the interaction of papermaking materials and chemical additives in the wetend of a papermachine system. The topics of retention of fine solids and dewatering are addressed in detail. Application of the various topics presented during the course are made during a pilot papermachine trial.
Prerequisite: Senior standing in PSE program or consent of the instructor.

PSE 468. Papermaking Processes ....(3)
Two hours of lecture and three hours of laboratory. Study of the papermaking process, featuring operation of the pilot paper machine. Emphasis is on the fundamentals of stock preparation, paper machine operation, evaluation of the finished product and the collection and analysis of data to develop material and energy balance. Results of each paper machine run are evaluated in seminar-type discussions. Spring.
Prerequisites: PSE 461 and PSE 465.

PSE 473. Mass Transfer ....(3)
Three hours of lecture. The study of mass transfer, humidification, air conditioning, drying, gas absorption, distillation, leaching, washing, and extraction. Fall.
Prerequisites: PSE 370, 371, and 372 or equivalent.

PSE 477. Process Control ....(3)
Two hours lecture and discussion and one to three hours computer lab or field trip per week. Presents an introduction to the principles of process control. Linear analysis, LaPlace transforms, and nonlinear simulation are presented and applied to feedback, feedforward, cascade and adaptive control. Examples of process simulation, accuracy and stability of control are drawn from paper industry processes.
Prerequisite: Differential equations or consent of the instructor. Senior standing desirable.

PSE 480. Process and Plant Design I: Analysis (3)
Engineering analysis of modern plant practice in the pulp and paper, chemical and related industries. Operating costs, profitability criteria, optimization techniques and evaluation of alternatives. Modeling and computer simulation of process units and systems; use of typical software. Design exercises and case studies. Spring.

PSE 481. Process and Plant Design II: Synthesis ....(3)
Design-project procedure; data sources and development. Application of simulation and computer-aided design to process synthesis and plant layout. Formulation and solution of original design problems. Fall.
Prerequisite: PSE 480 or permission of the instructor.

PSE 491. Paper Science and Engineering Project I ....(1)
Student makes a systematic survey of all available literature on the problem assigned him and incorporates it in a formal, typewritten report. An essential part of this report is a detailed outline of a research project which the student may undertake during the next semester (PSE 492). Fall.
Prerequisites: PSE 300 and PSE 301.

PSE 492. Paper Science and Engineering Project II ....(3)
The analysis of a problem, the synthesis of a solution and the basic design of the facilities needed to solve a problem. Laboratory research, field work, and consulting as needed in addition to the literature survey completed in PSE 491. Progress reports and a final report and seminar-style presentation. Spring.
Prerequisite: PSE 491.

PSE 496. Special Topics ....(1-3)
Lectures, conferences, and discussions. Specialized topics in chemistry, chemical engineering, and physics as well as topics pertaining to management as related to the pulp, paper, paperboard, and allied industries. Fall and Spring.

PSE 498. Research Problem ....(1-4)
The student is assigned a research problem in pulping, bleaching, refining, additives, quality control of paper or paper products, or chemical engineering. The student must make a systematic survey of available literature on the assigned problem. Emphasis is on application of correct research technique rather than on the results of commercial importance.The information obtained from the literature survey, along with the data developed as a result of the investigation, is to be presented s a technical

report. Fall, Spring, and Summer.
Prerequisites: PSE 461 and PSE 465.

WPE—WOOD PRODUCTS ENGINEERING

WPE 300. Properties of Wood for Designers ...(2)
Two hours of lecture. An introduction to the basic structure and properties of wood for the designer. Discussion of the effects of wood structure and properties on practical woodworking techniques. Fall.

WPE 322. Mechanical Processing ....(3)
Two hours of lecture and three hours of laboratory. Primary log reduction methods and industry practices. Lumber grading. Wood cutting principles. Machining practice in secondary wood-using industries. Experience in the operation of certain primary and secondary machining equipment.

WPE 326. Fluid Treatments ....(2)
Two hours of lecture. An introduction to wood-moisture relationships, wood permeability and pressure treatments, thermal conductivity, water-vapor movement, and drying and fire retardancy. The flow of fluids, heat and water vapor are treated as analogous phenomena and are related to the cellular structure of wood. Unsteady-state flow of gases, heat and water vapor are introduced. Spring.

WPE 327. Fluid Treatments Laboratory ....(1)
Three hours of laboratory. Laboratory studies in relative humidity measurement, wood-moisture relationships, the relationship between permeability and treatability, wood-preservative treatments, wood drying and flame testing. Spring.
Prerequisite: WPE 326 (or concurrent).

WPE 330. Building Codes and Zoning Practices (3)
This course shall introduce the student to the New York State Building Code and local fire, zoning and administrative ordinances pertaining to the construction and maintenance of buildings. The student shall be introduced to building system classification; systems components including mechanical, electrical, fire, and structural elements; and the need for safety regulations governing construction and occupancy of buildings. Emphasis shall be placed on construction plans review and code enforcement administration. Fall or Spring.

WPE 331. Construction Safety ....(3)
Introduction to Occupational Safety and Health Practices in the construction industry. This course provides an overview of the U.S. Department of Labor, Occupational Safety and Health Regulations 1910 and 1926 Standards. Coursework includes a detailed study of Construction Safety and Hazardous Communications programs. Topics include personal productive equipment, tools, electrical power, ladders and scaffolding, floor and wall openings, cranes and power equipment, concrete work, erection and demolition. Fall.

WPE 332. Mechanical and Electrical Equipment ....(3)
This course shall introduce the basic concepts of mechanical systems design and construction for residential and commercial buildings. Systems design and equipment selection are performed for heating, cooling, plumbing, sanitation, electrical, lighting, and acoustics. Emphasis is placed on the use of the New York State Building Code, the New York State Energy Conservation Code, the National Electrical Code, and the American Society of Heating, Refrigeration and Air Conditioning Engineering Manual. Spring.

WPE 335. Cost Engineering ....(3)
Methods and procedures for analyzing and forecasting costs. Equivalence. Comparative cost evaluation of alternatives. Depreciation and Taxes. Profitability. Break-even and minimum cost analysis. Productivity. Capital, operating, and equipment costs. Linear programming applications. Fall.

WPE 342. Light Construction.......................(3)
Three hours of lecture. Elements of structural design, light-frame construction, blueprint reading, and estimating. Fall.

WPE 343. Construction Estimating ....(3)
Introduction to construction estimating by the quantity takeoff method. Residential and commercial estimates shall be performed by the student using Walker and Means references. The student shall be introduced to the use of spreadsheet and estimating software for construction estimate preparation. Fall or Spring.
Prerequisite: WPE 342 or permission of the instructor.

WPE 350. Construction Methods and Equipment ....(3)
The study of production, methods and costs of heavy construction equipment. Analysis of heavy construction operations. Economics of equipment use. The fundamental objective will be the selection of methods and equipment that will result in the most effective and efficient performance. Fall.
Prerequisite: ERE 221 or equivalent.

WPE 386. Structure and Properties of Wood ....(2)
Two hours of lecture. Structure of wood in relation to defects, properties and uses. The variability of wood. Spring.

WPE 387. Wood Structure and Properties ....(3)
Three hours of lecture. Structure of wood and its relation to physical properties and uses. The normal variability of wood, abnormal growth, defects, deterioration of wood and their influence on properties and uses. Fall.

WPE 388. Wood and Fiber Identification Laboratory ....(2)
Six hours of laboratory. Wood and papermaking fiber identification using both gross and microscopic features. Fall.
Prerequisite: WPE 387 to be taken concurrently or previously.

WPE 389. Wood Identification Laboratory ....(1)
Three hours of laboratory. Identification of principal commercial timbers of United States on gross characteristics. Spring.
Prerequisite: WPE 387.

WPE 390. Fiber Identification Laboratory ......(1)
Three hours of laboratory. Identification of woody and nonwoody papermaking fibers. Spring.
Prerequisite: WPE 387.

WPE 399. Field Trip....................................(1)
One week immediately following the spring semester supervised study and reporting of representative wood products industries and construction sites. Estimated individual expenses are about $250 while on the trip.

WPE 400. Introduction to Forest Products ....(3)
Three hours of lecture. Characteristics of the products of the forest tree and manufacture of wood products. Spring.

WPE 401. Creative Approaches to Management(3)
Three hours of lecture and recitation with a workshop/seminar emphasis. Provides practical guidelines for dealing effectively with modern managerial problems that require new thinking. This course uses relevant, real-life examples, practical applications, and develops creative approaches. It is designed for individuals who intend to or are engaged in managing people and activities in achieving both organizational and personal goals. Spring.

WPE 404. Timber Design Project...................(3)
Lectures, discussion, and laboratory. Mechanical testing of wood, development of working stresses, design of a model structure, and construction and testing of the structure. Spring.
Prerequisites: Mechanics of materials and senior standing or permission of the instructor (ERE 362, CIE 325, or equivalent).

WPE 413. Computer-Aided Senior Project.......(3)
Open-ended real life design projects with microcomputer aids. Systems approach is emphasized. Project requirements, system selection, approximate design, value engineering, and final design are among design aspects considered. Analytical and model analysis. Spring.
Prerequisite: FEG 410 or equivalent.

WPE 414. Computer Applications in Engineering.......................................(3)
Microcomputer applications in a broad spectrum of selected topics in engineering sciences and practice. Hands-on experience is emphasized. Coursework is directed towards solving real life engineering problems. Software are provided and used. No computer programming or skills are required. Spring.
Prerequisite: FEG 410 or equivalent.

WPE 420. Adhesives, Sealants, and Coatings ....(3)
Two hours of lecture and three hours of laboratory. An introduction to adhesives, sealants, and coatings used in the wood products and building construction industries. All three types of materials, based upon polymers, will be evaluated in terms of their properties and respective technologies. Emphasis will be placed on knowing how to apply this knowledge to understand current practice and problem solving. Laboratory demonstrations to identify materials, methods of application, and methods of evaluating these materials. Fall.
Prerequisite: Junior standing.

WPE 422. Composite Materials ....(3)
Two hours of lecture, three hours of lab. Proper use of plywood, particleboard, oriented strandboard, waferboard, fiberboard, laminated veneer lumber, parallel strand lumber, laminated beams, wood polymer composites in building construction and/or furniture based upon physical and strength properties of these materials. Design considerations include: allowable design loads; applications such as beams, trusses, and sheathing; screw, nail, and bolt connections. Laboratory exercises will be patterned after ASTM standard tests to evaluate the physical and mechanical properties of these materials with written reports to be submitted by each student. Spring.
Prerequisites: WPE 387, Concurrent or prior registration in ERE 362 desirable.

WPE 453: Construction Planning and Scheduling.. ....(3)
Methods and concepts for planning and scheduling of operations and resources on construction projects. Topics include Gantt charts, progress curves, critical path methods, and project networking techniques. Microcomputer applications. Fall.

WPE 454. Construction Project Management ....(3)
Integration and application of methods and techniques for managing construction projects. Organizations. Project administration. Contractor's Management Accounting. Microcomputer applications. Spring.
Prerequisites: Construction Planning and Scheduling and senior standing or permission of the instructor.

WPE 455. Construction Contracts and Specifications ....(3)
Introduction of the types of contracts used in the construction industry. Analysis of the contractor's, designer's, and owner's duties and obligations as determined by the construction contract documents. Study of concepts, language, formats, and procedures for project manual organization practice and the general conditions of the contract for construction. Spring.

WPE 497. Senior Seminar for Wood Products Engineering Majors ....(2)
Discussion and assigned reports in current problems and new developments in Wood Products Engineering. Fall.

WPE 498. Research or Design Problem ....(1-3)
Conferences, library, laboratory and/or field research on a specific problem in Wood Products Engineering. Typewritten report (original and one copy) required. Fall, Spring, and Summer.
Prerequisite: Permission of the instructor and advisor.

State University of New York

STATE UNIVERSITY OF NEW YORK

Chancellor of the University
D. BRUCE JOHNSTONE, B.A., M.A.T., Ph.D.

Secretary of the University
MARTHA J. DOWNEY, B.S., M.A.

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State University's 64 geographically dispersed campuses bring educational opportunity within commuting distance of virtually all New York citizens and comprise the nation's largest, centrally managed system of public higher education.

When founded in 1948, the University consolidated 29 State-operated, but unaffiliated, institutions. In response to need, the University has grown to a point where its impact is felt educationally, culturally, and economically the length and breadth of the state.

Nearly 379,000 students are pursuing traditional study in classrooms or are working at home, at their own pace, through such innovative institutions as Empire State College, whose students follow individualized and often nontraditional paths to a degree. Of the total enrollment, more than 100,000 students are 24 years or older, reflecting State University's services to specific constituencies, such as refresher courses for the professional community, continuing education opportunities for returning service personnel, and personal enrichment for more mature persons.

State University's research contributions are helping to solve some of modern society's most urgent problems. It was a State University scientist who first warned the world of potentially harmful mercury deposits in canned fish, and another who made the connection between automobile and industrial exhaust combining to cause changes in weather patterns. Other University researchers continue important studies in such wide-ranging areasas immunology, marine biology, sickle-cell anemia, and organ transplantation.

More than 1,000 Public Service activities are currently being pursued on State University campuses. Examples of these efforts include special training courses for local government personnel, State civil service personnel, and the unemployed; participation by campus personnel in joint community planning or project work, and campus-community arrangements for community use of campus facilities.

A distinguished faculty includes nationally and internationally recognized figures in all the major disciplines. Their efforts are recognized each year in the form of such prestigious awards as Fulbright-Hays, Guggenheim, and Danforth Fellowships.

The University offers a wide diversity of what are considered the more conventional career fields, such as business, engineering, medicine, teaching, literature, dairy farming, medical technology, accounting, social work, forestry, and automotive technology. Additionally, its responsiveness to progress in all areas of learning and to tomorrow's developing societal needs has resulted in concentrations which include pollution, urban studies, computer science, immunology, preservation of national resources, and microbiology.

SUNY programs for the educationally and economically disadvantaged have become models for delivering better learning opportunities to a once-forgotten segment of society. Educational Opportunity Centers offer high school equivalency and college preparatory courses to provide young people and adults with the opportunity to begin college or to learn marketable skills. In addition, campus based Educational Opportunity Programs provide counseling, developmental education and financial aid to disadvantage students in traditional degree programs.

Overall, at its EOC's, two-year college, four-year campuses and university and medical centers, the University offers 3,600 academic programs. Degree opportunities range from two-year associate programs to doctoral studies offered at 12 senior campuses.

The 30 two-year community colleges operating under the program of State University play a unique role in the expansion of educational opportunity. They provide local industry with trained technicians in a wide variety of occupational curriculums, and offer transfer options to students who wish to go on and earn advanced degrees.

The University passed a major milestone in 1985 when it graduated its one-millionth alumnus. The majority of SUNY graduates pursue careers in communities across the State.

State University is governed by a Board of Trustees, appointed by the Governor, which directly determines the policies to be followed by the 34 State-supported campuses. Community colleges have their own local boards of trustees whose relationship to the SUNY board is defined by law. The State contributes one-third to 40

percent of their operating cost and one-half of their capital costs.

The State University motto is: "To Learn - To Search - To Serve."

STATE UNIVERSITY OF NEW YORK

UNIVERSITY CENTERS

State University of New York at Albany
State University of New York at Binghamton
State University of New York at Buffalo
State University of New York at Stony Brook

COLLEGES OF ARTS AND SCIENCE

State University College at Brockport
State University College at Buffalo
State University College at Cortland
State University of New York Empire State College
State University College at Fredonia
State University College at Geneseo
State University College at New Paltz
State University College at Old Westbury
State University College at Oneonta
State University College at Oswego
State University College at Plattsburgh
State University College at Potsdam
State University College at Purchase

COLLEGES AND CENTERS FOR THE HEALTH SCIENCES

State University of New York Health Science Center at Brooklyn
State University of New York Health Science Center at Syracuse
State University of New York College of Optometry at New York City
(Health Sciences Center at SUNY at Buffalo)*
(Health Sciences Center at SUNY at Stony Brook)*

COLLEGES OF TECHNOLOGY and
COLLEGES OF AGRICULTURE AND TECHNOLOGY

State University of New York College of Technology at Alfred
State University of New York College of Technology at Canton
State University of New York College of Agriculture and Technology at Cobleskill
State University of New York College of Technology at Delhi
State University of New York College of Technology at Farmingdale
State University of New York College of Agriculture and Technology at Morrisville
State University of New York College of Technology at Utica/Rome**
(Upper-division and master's programs)
(Fashion Institute of Technology at New York City)***

SPECIALIZED COLLEGES

State University of New York College of Environmental Science and Forestry at Syracuse
State University of New York Maritime College at Fort Schuyler

STATUTORY COLLEGES****

NYS College of Agriculture and Life Sciences at Cornell University
NYS College of Ceramics at Alfred University
NYS College of Human Ecology at Cornell University
NYS School of Industrial and Labor Relations at Cornell University
NYS College of Veterinary Medicine at Cornell University

COMMUNITY COLLEGES

(Locally-sponsored, two-year colleges under the program of State University)

Adirondack Community College at Glens Falls
Broome Community College at Binghamton
Cayuga County Community College at Auburn
Clinton Community College at Plattsburgh
Columbia-Greene Community College at Hudson
Community College of the Finger Lakes at Canandaigua
Corning Community College at Corning
Dutchess Community College at Poughkeepsie
Erie Community College at Williamsville, Buffalo and Orchard Park
Fashion Institute of Technology at New York City***
Fulton-Montgomery Community College at Johnstown
Genesee Community College at Batavia
Herkimer County Community College at Herkimer
Hudson Valley Community College at Troy
Jamestown Community College at Jamestown
Jefferson Community College at Watertown
Mohawk Valley Community College at Utica
Monroe Community College at Rochester
Nassau Community College at Garden City
Niagara County Community College at Sanborn
North Country Community College at Saranac Lake
Onondaga Community College at Syracuse
Orange County Community College at Middletown
Rockland Community College at Suffern
Schenectady County Community College at Schenectady
Suffolk County Community College at Selden, Riverhead and Brentwood
Sullivan County Community College at Loch Sheldrake
Tompkins Cortland Community College at Dryden
Ulster County Community College at Stone Ridge
Westchester Community College at Valhalla

*The Health Sciences Centers at Buffalo and Stony Brook are operated under the administration of their respective University Centers.

**This is an upper-division institution authorized to offer baccalaureate and master's degree programs.

***While authorized to offer such baccalaureate and master's degree programs as may be approved pursuant to the provisions of the Master Plan, in addition to the associate degree, the Fashion Institute of Technology is financed and administered in the manner provided for community colleges.

****These operate as "contract colleges" on the campuses of independent universities.

College of Environmental Science and Forestry

ESF BOARD OF TRUSTEES

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Chair, Chemistry Faculty .... ANATOLE SARKO
Director, Polymer Research Institute .... ISRAEL CABASSO
Director, Cellulose Research Institute .... TORE E. TIMELL
Chair, Environmental and Forest Biology Faculty .... ROBERT L. BURGESS
Director, Adirondack Ecological Center .... WILLIAM F. PORTER
Chair, Environmental Studies Faculty .... RALPH A. SANDERS
Chair, Forest Engineering Faculty .... ROBERT H. BROCK, JR.
Chair, Forestry Faculty and Director, Division of Forest Resources .... BOB G. BLACKMON
Director, Forest Technology Program of the Forestry Faculty .... RICHARD W. MILLER
Chair, Landscape Architecture Faculty .... RICHARD S. HAWKS
Chair, Paper Science and Engineering Faculty .... LELAND R. SCHROEDER
Director, Empire State Paper Research Institute .... LELAND R. SCHROEDER
Chair, Wood Products Engineering Faculty .... LEONARD A. SMITH
Director, N. C. Brown Center for Ultrastructure Studies .... ROBERT B. HANNA
Director, Tropical Timber Information Center .... ROBERT W. MEYER
Vice President for Administration .... NICK J. PARADISO, JR.
Director of Administrative Computing .... DAVID J. SODERBERG
Director of Business Affairs .... MARK P. FENNESSY
Director of Forest Properties .... RICHARD A. SCHWAB
Director of Personnel and Affirmative Action .... MARCIA JAMES
Director of Physical Plant .... JAMES R. VESPI
Director of Public Safety .... KEVIN E. WALSH
Vice President for Student Affairs and Educational Services .... JAMES M. HEFFERNAN
Director of Admissions .... DENNIS O. STRATTON
Director of Alumni Affairs .... JUSTIN F. CULKOWSKI
Director of Career Planning .... THOMAS O. SLOCUM
Director of Financial Aid and Educational Opportunity Program .... JOHN E. VIEW
College Registrar .... ROBERT S. NORTH
Coordinator of Student Activities and Organizations .... VACANT

COLLEGE FACULTY AND PROFESSIONAL STAFF

DISTINGUISHED TEACHING PROFESSOR

GEORGE W. CURRY, *Distinguished Teaching Professor*, Landscape Architecture Faculty

DANIEL L. DINDAL, *Distinguished Teaching Professor*, Environmental and Forest Biology Faculty

MIKLOS A. J. GRATZER, *Distinguished Teaching Professor*, Forestry Faculty

DUDLEY J. RAYNAL, *Distinguished Teaching Professor*, Environmental and Forest Biology Faculty

DISTINGUISHED ADJUNCT PROFESSOR

HARRY L. FRISCH, *Distinguished Adjunct Professor*, Chemistry Faculty

DISTINGUISHED SERVICE PROFESSOR EMERITUS

WILFRED A. CÔTÉ, JR., *Distinguished Service Professor*, Wood Products Engineering Faculty

DISTINGUISHED TEACHING PROFESSOR EMERITUS

EDWIN H. KETCHLEDGE, *Distinguished Teaching Professor Emeritus*, Environmental and Forest Biology Faculty

THEODORE J. STENUF, *Distinguished Teaching Professor Emeritus*, Paper Science and Engineering Faculty

DISTINGUISHED PROFESSOR EMERITUS

CONRAD SCHUERCH, *Distinguished Professor Emeritus*, Chemistry Faculty

MICHAEL M. SZWARC, *Distinguished Professor Emeritus*, Polymer Research Institute

FACULTY AND PROFESSIONAL STAFF

This listing represents an official record of the State University of New York College of Environmental Science and Forestry faculty and professional staff for 1992. It is designed for use in 1992-93.

The date in parentheses after each name denotes the first year of service, two or more dates, the term of service.

LAWRENCE P. ABRAHAMSON (1977), *Senior Research Associate*, Forestry Faculty and Environmental and Forest Biology Faculty; B.S., Michigan Technological University, 1964; M.S., University of Wisconsin, 1967; Ph.D., 1969

DOUGLAS C. ALLEN (1968), *Professor*, Environmental and Forest Biology Faculty; B.S., University of Maine, 1962; M.S., 1965; Ph.D., University of Michigan, 1968

WAYNE ALLEN (1979), Forest Property Technician I, Wanakena Campus

RAYMOND J. APPLEBY (1982), *Instructional Support Technician*, Paper Science and Engineering Faculty; A.S., State University of New York Columbia-Greene, 1980

HENRY T. APPLETON (1989), *Adjunct Associate Professor*, Environmental and Forest Biology Faculty; B.S., State University of New York College of Environmental Science and Forestry, 1971; Ph.D., 1976

ROBERT W. ARSENEAU (1972), *Senior Programmer/Analyst*, Administrative Computing; A.A.S., Mohawk Valley Community College, 1967; B.S., Syracuse University, 1978

DONALD E. ARTZ (1987), *Project Staff Assistant*, Office of Research Programs; B.S., SUNY Oswego, 1987

CAROLINE B. BAILEY (1978), *Senior Staff Assistant*, Landscape Architecture Faculty

GUY BALDASSARRE (1987), *Associate Professor*, Environmental and Forest Biology Faculty; B.S., University of Maine, 1975; M.S., University of Wisconsin, Stevens Point; 1978; Ph.D., Texas Tech University, 1982

JAMES P. BAMBACHT (1967), *Professor*, Paper Science and Engineering Faculty; A.B., Kalamazoo College, 1954; M.S., The Institute of Paper Chemistry, 1956; Ph.D., State University of New York College of Environmental Science and Forestry, 1973

MARCIA A. BARBER (1989), *Personnel Associate*, Personnel and Affirmative Action; B.A., State University of New York at Brockport, 1980

GEORGE R. BATTLES (1987), *Instructional Support Specialist*, Analytical and Technical Services; A.A.S., SUNY Agricultural and Technical College, Morrisville, 1966; B.E.T., Rochester Institute of Technology, 1973

JOHN D. BENNETT (1960), *Associate Professor*, Forestry Faculty; B.A., Ohio Wesleyan University, 1954; Ph.D., Syracuse University, 1968; Chancellor's Award for Excellence in Teaching (1973)

DONALD H. BICKELHAUPT (1969), *Instructional Support Specialist*, Forestry Faculty; B.S., State University of New York College of Forestry, 1970; M.S., State University of New York College of Environmental Science and Forestry, 1980

ARTHUR J. BILCO (1983), Staff Associate, Physical Plant

PETER E. BLACK (1965), *Professor*, Forestry Faculty; B.S., University of Michigan, 1956; M.F., 1958; Ph.D., Colorado State University, 1961; Executive Chairman of the Faculty (1974-78)

BOB G. BLACKMON (1987), *Chair and Professor*, Forestry Faculty; Director, Division of Forest Resources; B.S., Louisiana Tech University, 1962; M.F., Duke University, 1963; Ph.D., Louisiana State University, 1969

RAYMOND W. BLASKIEWICZ (1982), *Associate College Registrar*, Student Affairs and Educational Services; B.S., State University of New York College of Environmental Science and Forestry, 1979; M.S., Syracuse University, 1988

CONSTANCE H. BOBBIE (1982), *Associate Librarian*, F. Franklin Moon Library/Learning Resources Center; B.S., Bemidji State College, 1956; M.A., University of Minnesota, 1962

WILLIAM R. BORGSTEDE (1971), *Instructional Support Technician*, Environmental and Forest Biology Faculty; A.A.S., Miner Institute, 1966; A.A.S., State University of New York College at Delhi, 1970; B.S., State University of New York College of Environmental Science and Forestry, 1975; M.S., Syracuse University; 1978

GREGORY L. BOYER (1985), *Associate Professor*, Chemistry Faculty; A.S., Reedley College, 1973; A.B., University of California, 1975; Ph.D., University of Wisconsin, 1980

STEPHEN B. BRANDT (1983), *Adjunct Associate Professor*, Environmental and Forest Biology Faculty; B.A., University of Wisconsin, 1972; M.S., 1975; Ph.D., 1978

BRUCE W. BREITMEYER (1983), *Forest Property Manager* I, Adirondack Forest Properties; B.S.F., University of Michigan, 1975; M.S., 1982

JEROME BREZNER (1961), *Professor*, Environmental and Forest Biology Faculty; A.B., University of Rochester, 1952; A.M., University of Missouri, 1956; Ph.D., 1959; Postdoctoral, Dartmouth Medical School, 1960; Executive Chairman of the Faculty, (1974-76); State University of New York Senator, (1984-87)

MICHAEL R. BRIDGEN (1992), *Assistant Professor*, Forest Technology Program of the Forestry Faculty; B.S., Pennsylvania State University, 1975; Ph.D., Michigan State University, 1979

ROBERT H. BROCK, JR. (1967), *Chair and Professor*, Forest Engineering Faculty; Director of the Division of Engineering; B.S., State University of New York College of Forestry, 1958; M.S., 1959; Ph.D., Cornell University, 1971

RAINER H. BROCKE (1969), *Associate Professor*, Environmental and Forest Biology Faculty; Co-Director, Adirondack Wildlife Program; B.S., Michigan State University, 1955; M.S., 1957; Ph.D., 1970

ALTON F. BROWN (1963), *Research Support Specialist*, Empire State Paper Research Institute

THOMAS E. BROWN (1977), *Adjunct Assistant Professor*, Environmental and Forest Biology Faculty; B.S. Niagara University, 1957; M.S., State University of New York College of Forestry, 1968

PATRICIA BURAK (1983), *Adjunct Advisor to Foreign Students and Scholars*, Office of Student Affairs and Educational Services; B.A., State University of New York College at Oswego, 1973; M.A., State University of New York College at Albany, 1974

ROBERT L. BURGESS (1981), *Chair and Professor*, Environmental and Forest Biology Faculty; B.S., University of Wisconsin, Milwaukee, 1957; M.S., University of Wisconsin, Madison, 1959; Ph.D., 1961

KENNETH F. BURNS (1970), *Instructional Support Technician*, Forestry Faculty; A.A.S., Paul Smith's College, 1969

ISRAEL CABASSO (1981), *Professor*, Chemistry Faculty; Director, Polymer Research Institute; B.S., Hebrew University, 1966; M.S., 1968; Ph.D. Weizmann Institute of Science, 1973

PAUL M. CALUWE (1969), *Associate Professor*, Chemistry Faculty; Associate Member, Polymer Research Institute; Ph.D., University of Leuven, Belgium, 1967

ROBERT W. CAMPBELL (1984), *Adjunct Professor*, Environmental and Forest Biology Faculty; B.S., New York State College of Forestry, 1953; M.S., University of Michigan, 1959; Ph.D., 1961

HUGH O. CANHAM (1966), *Professor*, Forestry Faculty; B.S., State University of New York College of Forestry, 1960; M.S., 1962; Ph.D., 1971

EMANUEL J. CARTER, JR. (1985), *Assistant Professor*, Landscape Architecture Faculty; B.A., Cornell University, 1969; Master of Regional Planning, 1978

JOHN D. CASTELLO (1978), *Associate Professor*, Environmental and Forest Biology Faculty; B.A., Montclair State College, 1973; M.S., Washington State University, 1976; Ph.D., University of Wisconsin, 1978

H. PETER CASTRO (1990), *Adjunct Assistant Professor*, Forestry Faculty; B.A., University of California, 1977; M.A., 1981; Ph.D., 1988

ROBERT E. CHAMBERS (1967), *Professor*, Environmental and Forest Biology Faculty; B.S., Pennsylvania State University, 1954; M.S., 1956; Ph.D., Ohio State University, 1972

DIANE CHEPKO-SADE (1989), *Adjunct Assistant Professor*, Environmental and Forest Biology Faculty; B.A., Duke University, 1971; M.A., University of Puerto Rico, 1977; Ph.D., Northwestern University, 1982; M.S., 1987

GARY E. COLELLA (1986), *Facilities Program Coordinator*, Physical Plant; A.A.S., Auburn Community College, 1963

SHIRLEY CONNAL (1981), *Personnel Associate*, Personnel and Affirmative Action

JAMES E. COUFAL (1961), *Professor/Undergraduate Education Coordinator*, Forestry Faculty; Certificate, State University of New York College of Forestry (Ranger School), 1957; B.S., State University of New York College of Forestry, 1960; M.S., 1962; Ed.S., State University of New York at Albany, 1976

PHILLIP J. CRAUL (1968), *Professor*, Forestry Faculty; B.S.F., Pennsylvania State University, 1954; M.S., 1960; Ph.D., 1964

JAMES O. CREVELLING (1970), *Forest Property Manager*, Experiment Station and Heiberg Forest, Wanakena and Cranberry Campuses; A.A.S., Paul Smith's College, 1965; B.S., University of Massachusetts, 1967

CLAY M. CROSBY (1964), *Research Scientist*, Empire State Paper Research Institute; B.S., State University of New York College of Forestry, 1964; M.S., 1970

JUSTIN F. CULKOWSKI (1978), *Director of Alumni Affairs*, Student Affairs and Educational Services; B.S., State University of New York College of Environmental Science and Forestry, 1973; M.B.A., Syracuse University, 1983; NYS/UUP Excellence Award, 1991

TIBERIUS CUNIA (1968), *Professor*, Forestry Faculty; Forest Engineer, Ecole Nat. des Eaux et Forets, Nancy-France, 1951; M.S., McGill University, Montreal, Canada, 1957

GEORGE W. CURRY (1966), *Distinguished Teaching Professor*, Landscape Architecture Faculty; B.A., Michigan State University, 1962; B.S., 1965; M.L.A., University of Illinois, 1969

ROBERT J. CYMBALA (1992), *Senior Research Support Specialist*, Environmental and Forest Biology Faculty; B.S., State University of New York College of Environmental Science and Forestry, 1988

BENJAMIN V. DALL (1975), *Professor*, Environmental Studies Faculty; B.S., Yale University, 1955; M.F., 1956; J.D., Univer-ity of Virginia, 1959; Ph.D., Pennsylvania State University, 1972

CRAIG J. DAVIS (1987), *Assistant Professor*, Forestry Faculty; A.A.S., Williamsport Area Community College, 1978; B.S.F.E., University of Maine, 1982; M.S.F., Purdue University, 1984; Ph.D., 1987

CHAD DAWSON (1986), *Assistant Professor*, Forestry Faculty; B.S., University of Michigan, 1970; M.P.S., Cornell University, 1979; Ph.D., State University of New York College of Environmental Science and Forestry, 1983

ARNOLD C. DAY (1947), *Instructional Support Specialist*, N.C. Brown Center for Ultrastructure Studies

SALVACION DE LAPAZ (1973), *Associate Librarian*, F. Franklin Moon Library/Learning Resources Center; B.S.L.S., University of the Philippines, 1956; M.S.L.S., Simmons College, 1962

CHARLOTTE DEMERS (1990), *Instructional Support Associate*, Newcomb Campus; A.A.S., Holyoke Community College, 1984; B.S., State University of New York College of Environmental Science and Forestry, 1986

DANETTE J. DESIMONE (1990), *College Accountant*, Business Affairs; B.S., Lemoyne College, 1986; C.P.A., NYS Education Department, 1988

DANIEL L. DINDAL (1966), *Distinguished Teaching Professor*, Environmental and Forest Biology Faculty; B.S. Ed. and B.S. Agri., Ohio State University, 1958; M.A., 1961; Ph.D., 1967; Chancellor's Award for Excellence in Teaching (1974)

MARTA L. DOSA (1987), *Adjunct Professor*, Environmental Studies Faculty; B.A., University of Budapest Comparative Literature, 1943; M.A., 1944; M.S.L.S., Syracuse University Library Science, 1957; Ph.D., University of Michigan Library Science, 1971

ALLAN P. DREW (1980), *Associate Professor*, Forestry Faculty; B.S., University of Illinois, 1965; M.S., University of Arizona, 1967; Ph.D., Oregon State University, 1974

DAVID A. DRISCOLL (1986), *Senior Research Associate* and Director, Analytical and Technical Services; A.A.S., State University of New York Agricultural and Technical College at Farmingdale, 1964; B.S., M.S., Fairleigh Dickinson University, 1974; Ph.D., Fordham University, 1978

MARK DRISCOLL (1986), *Instructional Support Specialist*, ResearchPrograms; A.A., State University of New York Agricultural and Technical College at Delhi, 1979; B.S., St. John's University, 1982

MICHAEL J. DUGGIN (1979), *Professor*, Forest Engineering Faculty; B.Sc., Melbourne University, Australia, 1959; Ph.D., Monash University, Australia, 1965; F. Inst. P. (London), C. Phys. (London), F.O.S.A.

JAMES S. DUNCAN (1990), *Adjunct Professor*, Landscape Architecture Faculty; B.A., Dartmouth College, 1970; M.A. Syracuse University, 1974; Ph.D., 1977

STEVEN EFFLER (1991), *Adjunct Associate Professor*, Environmental Studies Faculty; B.S., University of Notre Dame, 1968; M.S., Institute of Polymer Science, 1971; Ph.D., Syracuse University, 1975

ANDREW L. EGGERS (1967), *Assistant for Instructional Resources*, Instructional Services

ELIZABETH A. ELKINS (1973), *Associate Librarian*, F. Franklin Moon Library/Learning Resources Center; B.A., Hartwick College, 1968; M.L.S., State University of New York at Geneseo, 1970; Chancellor's Award for Excellence in Librarianship (1980); Executive Chair of Faculty (1986-88)

AMINUR EUSUFZAI (1973), *Research Scientist*, Empire State PaperResearch Institute; B.Sc. (Hons.), Dacca University, 1957; M.Sc., 1960; B.Sc. (Hons.) Forestry, Peshawar University, 1962; M.S., West Virginia University, 1969; M.S., State University of New York College of Environmental Science and Forestry, 1982

F. W. GORDON FEARON (1986), *Adjunct Professor*, Chemistry Faculty; Associate Member, Polymer Research Institute; G.S., University of Leeds, 1961; Ph.D., University of Wales, 1965; P.M.D., Harvard Business School, 1975

JOHN P. FELLEMAN (1973), *Professor* and *Director of Graduate Program*, Environmental Studies Faculty; B.C.E., Cornell University, 1966; M.E.C., 1966; N.D.E.A. Fellow, University of North Carolina, 1967; D.P.A., New York University, 1973; New York State Professional Engineer

MAUREEN O'NEILL FELLOWS (1986), *Director*, Institutional Research and *Assistant to the President for Planning*; A.B., Hamilton College, 1980; M.S., Cornell University, 1985; Ph.D., Syracuse University, 1992; Chancellor's Award for Excellence in Professional Service, 1992

MARK P. FENNESSY (1989), *Director*, Business Affairs; B.A., State University of New York at Buffalo, 1968; M.B.A., State University of New York at Buffalo, 1983

MATTHAIS P. FINGER (1990), *Adjunct Assistant Professor*, Forestry Faculty; M.A., University of Geneva, 1982, 1985; Ph.D., 1986, 1987

JOHN S. FISHLOCK (1965), *Instructional Support Technician*, Environmental and Forest Biology Faculty; A.A.S., State University of New York College of Forestry, 1975

RAYMOND C. FRANCIS (1987), *Research Associate*, Paper Science and Engineering Faculty; B.A.Sc., University of Toronto, 1982; Ph.D., 1987

CLAUDE C. FREEMAN (1959), *Associate Professor*, Landscape Architecture Faculty; B.S. in Landscape Architecture, State University of New York College of Forestry, 1959

ROBERT H. FREY (1977), *Dean of Instruction* and *Graduate Studies/Associate Professor*; B.A., Valparaiso University, 1965; M.Ed., Springfield College, 1966; Ed.D., Indiana University, 1973

HARRY L. FRISCH (1980), *Adjunct Professor*, Chemistry Faculty; *Associate Member*, Polymer Research Institute; A.B., Williams College, 1947; Ph.D., Polytechnic Institute of Brooklyn, 1952

ARTHUR J. FRITZ, JR. (1985), *Director of Development*, A.B., Syracuse University, 1962

DOUGLAS H. FROST (1982), *Assistant Director*, Business Affairs; A.A., College of San Mateo, 1962; B.S., Wagner College, 1967

LINDA M. GALLOWAY (1990), *Instructional Support Specialist*, Environmental and Forest Biology Faculty; B.S., Long Island University, 1980

RONALD J. GIEGERICH (1977), *Instructional Support Specialist*, Environmental and Forest Biology Faculty; A.A.S., State University of New York Agricultural and Technical College at Cobleskill, 1975; B.S., State University of New York College of Environmental Science and Forestry, 1978

MICHAEL GOODEN (1982), *Forest Property Technician I*, Newcomb Campus; A.A.S., State University of New York Agricultural and Technical College at Morrisville, 1976; B.S., State University of New York College of Environmental Science and Forestry, 1978

W. DOUGLAS GOULD (1983), *Adjunct Assistant Professor*, Environmental and Forest Biology Faculty; B.S., University of Manitoba, 1965; M.S., University of Alberta, 1970; Ph.D., 1976

DANIEL GRAIVER (1989), *Adjunct Professor*, Chemistry Faculty; Associate Member, Polymer Research Institute; B.S., Hebrew University of Jerusalum, 1971; M.S., 1973; Ph.D., Case Western Reserve University, 1977

STEPHEN GRANZOW (1969), *Research Support Specialist*, Empire State Paper Research Institute

MIKLOS A. J. GRATZER (1973), *Distinguished Teaching Professor,* Forestry Faculty; Forest Engineer, Sopron University; B.Sc., University of British Columbia, 1959; M.S. (R.C.), University of Montana, 1965; Ph.D., 1971; D.h.c., Sopron University, 1992

CHARLES GREEN, JR. (1979), *Adjunct Professor,* Paper Science and Engineering Faculty; B.S., University of Iowa, 1956

SIDNEY L. GREENBLATT (1990), *Adjunct Associate Foreign Student Counselor,* Student Affairs and Educational Services; B.A. State University of New York at Binghamton, 1960; M.A., Columbia University, 1961; East Asian Certificate, Columbia University, 1963

DAVID H. GRIFFIN (1968), *Professor,* Environmental and Forest Biology Faculty; B.S., State University of New York College of Forestry, 1959; M.A., University of California, 1960; Ph.D., 1963

DANIEL A. GRIFFITH (1992), *Adjunct Professor,* Forestry Faculty; B.S., Indiana University of Pennsylvania, 1970; M.A., 1972; M.S., Pennsylvania State University, 1985; Ph.D., University of Toronto, 1978

KEVIN J. GUERIN (1988), *Instructional Support Specialist,* Analytical and Technical Services; A.A.S., Onondaga Community College, 1987

CHARLES A. S. HALL (1987), *Associate Professor,* Environmental and Forest Biology Faculty; B.A., Colgate University, 1965; M.S., Pennsylvania State University, University Park, 1966; Ph.D., University of North Carolina Chapel Hill, 1970

JAMES P. HALLIGAN (1979), *Instructional Support Specialist,* Forestry Faculty; B.S., State University of New York College of Environmental Science and Forestry, 1974

JUDITH C. HAMILTON (1979), *Financial Aid Advisor,* Student Affairs and Educational Services; B.S., State University of New York College at Brockport, 1967; M.S., State University of New York at Albany, 1968

ROBERT B. HANNA (1977), *Director,* N.C. Brown Center for Ultrastructure Studies; Professor, Wood Products Engineering Faculty; B.S., University of Michigan, 1967; M.S., State University of New York College of Forestry, 1971; Ph.D., State University of New York College of Environmental Science and Forestry, 1973

DAVID L. HANSELMAN (1963), *Professor,* Landscape Architecture Faculty; B.S., Cornell University, 1957; M.S., 1958; Ph.D., The Ohio State University, 1963

JAMES M. HASSETT (1981), *Associate Professor,* Forest Engineering Faculty; A.B., Cornell University, 1970; M.S., Syracuse University, 1979; Ph.D., 1988; Chancellor's Award for Excellence in Teaching, 1992

JOHN P. HASSETT (1980), *Associate Professor,* Chemistry Faculty; B.S., University of Maryland, 1971; M.S., University of Wisconsin, 1973; Ph.D., 1978

RICHARD S. HAWKS (1979), *Chair* and *Associate Professor,* Landscape Architecture Faculty; B.L.A., State University of New York College of Environmental Science and Forestry, 1972; M.L.A., Harvard University, 1978

JAMES M. HEFFERNAN (1985), *Vice President for Student Affairs and Educational Services;* A.B., Lafayette College, 1965; M.A., Columbia University Teachers College, 1967; M.A., University of Michigan, 1970; Ph.D., 1971

GORDON M. HEISLER (1973), *Adjunct Associate Professor,* Forestry Faculty; B.S., Pennsylvania State University, 1961; M.F., Yale University, 1962; Ph.D., State University of New York College of Forestry, 1970

ROBERT D. HENNIGAN (1967), *Professor* and *Undergraduate Coordinator,* Environmental Studies Faculty; B.C.E., Manhattan College, 1949; M.A., Syracuse University, 1964, P.E., New York State

LEE P. HERRINGTON (1965), *Professor,* Forestry Faculty; B.S., University of Maine, 1959; M.F., Yale School of Forestry, 1960; Ph.D., Yale University, 1964

ROBERT A. HOLM (1982), *Associate Professor,* Paper Science and Engineering Faculty; B.S., University of Illinois, 1958; M.S., University of Delaware, 1961; Ph.D., 1962

WILLIAM HOLTZMAN (1987), *Assistant Professor,* Paper Science and Engineering Faculty; B.S.Ch.E., Pennsylvania State University, 1953; M.S., Lawrence University (The Institute of Paper Chemistry), 1955; Ph.D., 1959

MARY O'BRIEN HOOVEN (1980), *Staff Associate,* Wanakena and Cranberry Lake Campuses, B.A., State University of New York at Buffalo, 1972

PAUL F. HOPKINS(1979), *Assistant Professor,* Forest Engineering Faculty; Director, Geospatial Modeling and Analysis; B.S., University of Maine, 1977; M.S., State University of New York College of Environmental Science and Forestry, 1979

ALLEN F. HORN, JR.(1957), *Professor,* Forestry Faculty; B.S., Michigan State University, 1950; M.S., 1951; Ph.D., State University of New York College of Forestry, 1957; LL.B., Syracuse University, 1967

STEVEN B. HORSLEY (1977), *Adjunct Associate Professor,* Forestry Faculty; B.S., Pennsylvania State University, 1965; M.A., University of Massachusetts, 1968; Ph.D., University of Massachusetts, 1970

JOEL R. HOWARD (1974), *Assistant Professor,* Forestry Faculty;B.S., Director, Summer Program in Field Forestry; New York State Ranger School, 1966; B.S., State University of New York College of Environmental Science and Forestry, 1973; M.S., 1978; Ph.D., North Carolina State University, 1986

JOHN J. HOWARD (1978), *Adjunct Associate Professor,* Environmental and Forest Biology Faculty; B.A., University of New Hampshire, 1966; M.P.H., Yale University, 1970, Dr. P.H., 1973

RAFAAT M. HUSSEIN (1987), *Associate Professor,* Wood Products Engineering Faculty; B.Sc., El-Azhar University, 1974; M.Eng., Concordia University, 1978; Ph.D., 1980; P.E., 1980

MARY F. IDZIOR (1990), *Adjunct Associate Foreign Scholar Advisor,* Student Affairs and Educational Services; B.A,, State University of New York at Buffalo, 1981; J.D., 1984; M.A., 1987

MARCIA JAMES (1985), *Director,* Personnel and Affirmative Action; B.A., Grove City College, 1960; M.A., Cornell University, 1962; M.A., 1965; J.D., Syracuse University, 1978

ROBERT V. JELINEK (1972), *Professor,* Paper Science and Engineering Faculty; B.S., Columbia University, 1945; M.S., 1947; Ph.D., 1953

DAVID L. JOHNSON (1975), *Associate Professor,* Chemistry Faculty; B.S., Antioch College, 1965; Ph.D., University of Rhode Island, 1973

WILLIAM L. JOHNSON (1987), *Instructional Support Specialist,* Forest Engineering Faculty; B.S., University of Wisconsin, 1972; M.S., 1974

DIANNE M. JUCHIMEK (1967), *Associate Librarian,* F. Franklin Moon Library/Learning Resources Center; B.S., University of Illinois, 1965; M.S.L.S., Syracuse University, 1967

RONALD R. KARNS (1965), *Associate Director of Community Relations*, News and Publications; B.S., Ohio State University, 1954

JAMES KARP (1991), *Adjunct Professor*, Environmental Studies Faculty; B.S., Pennsylvania State University, 1960; J.D. Villanova University, 1964

WILLIAM L. KELLEHER, JR. (1988), *Instructional Support Technician*, Wood Products Engineering Faculty; B.S., State University of New York College of Environmental Science and Forestry, 1985

D. STEVEN KELLER (1990), *Research Support Specialist*, Paper Science and Engineering Faculty; B.S., Syracuse University, 1980

JOSEPH F. KEULER (1988), *Assistant Professor*, Wood Products Engineering Faculty; B.S., Pratt Institute, 1973; M.S., Rochester Institute of Technology, 1976; M.C.E., Manhattan College, 1978

DAVID J. KIEBER (1990), *Assistant Professor*, Chemistry Faculty; B.S., Rutgers University, 1980; M.S., University of Delaware, 1983; Ph.D., University of Miami, 1988

DAVID J. KIEMLE (1986), *Instructional Support Specialist*, Analytical and Technical Services, Office of Research Programs; B.S., State University of New York College at Oswego, 1983

JUDITH J. KIMBERLIN (1981), *Assistant Director*, Personnel and Affirmative Action; A.A.S., Pennsylvania State University, 1964; B.A., State University of New York College at Cortland, 1975

ROBERT C. KOEPPER (1986), *Dean of Nonresident Programs*; Continuing Education; B.A., Concordia Teachers College, 1958; M.A., 1962; Ed.D., George Peabody College for Teachers, 1966

RICHARD F. KOPP (1988), *Senior Research Support Specialist*, Forestry Faculty; B.S., State University of New York College of Environmental Science and Forestry, 1984; M.S., The Pennsylvania State University, 1986

DONALD E. KOTEN (1961), *Professor*, Forestry Faculty; B.A., North Central College, 1951; B.S., Oregon State College, 1957; Ph.D., State University of New York College of Forestry, 1966

STELLA D. KROFT (1960), *Staff Assistant*, Instructional Services

FRANK E. KURCZEWSKI (1966), *Professor* and *Curator*, Environmental and Forest Biology Faculty; B.S., Allegheny College, 1958; M.S., Cornell University, 1962; Ph.D., 1964

GEORGE H. KYANKA (1967), *Professor*, Wood Products Engineering Faculty; B.S., Syracuse University, 1962; M.S., 1966; Ph.D., 1976; Chancellor's Award for Excellence in Teaching (1973)

YUAN-ZONG LAI (1981), *Senior Research Associate*, Empire State Paper Research Institute; B.S., National Taiwan University, 1963; M.S., University of Washington, 1966; M.S., 1967; Ph.D., 1968

ROBERT T. LALONDE (1959), *Professor*, Chemistry Faculty; B.A., St. John's University, Minnesota, 1953; Ph.D., University of Colorado, 1957

DARLEEN M. LAPELLE (1978), *Staff Assistant*, Newcomb Campus

LOUISE W. LAUGHTON (1988), *Project Staff Associate*, News and Publications; B.A., Meredith College, 1959

PATRICK J. LAWLER (1990), *Assistant Professor*, F. Franklin Moon Library/Learning Resources Center; B.A., Lemoyne College, 1976; M .A., Syracuse University, 1981

CHARLES N. LEE (1959), *Professor*, Forest Engineering Faculty; Director, Academic Computing; B.S., New York State College of Forestry, 1949; B.C.E., Syracuse University, 1957; M.C.E., 1959

DONALD LEOPOLD (1985), *Associate Professor*, Environmental and Forest Biology Faculty; B.S., University of Kentucky, 1978; M.S.F., 1981; Ph.D., Purdue University, 1984

ALLEN R. LEWIS (1970), *Associate Professor*, Landscape Architecture Faculty; B.A., University of Oklahoma, 1959; M.C.P., University of California, Berkeley, 1961; Executive Chairman of the Faculty (1978-1982)

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ADDITIONAL INFORMATION

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